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EDITED BY

THEO. S. CASE.

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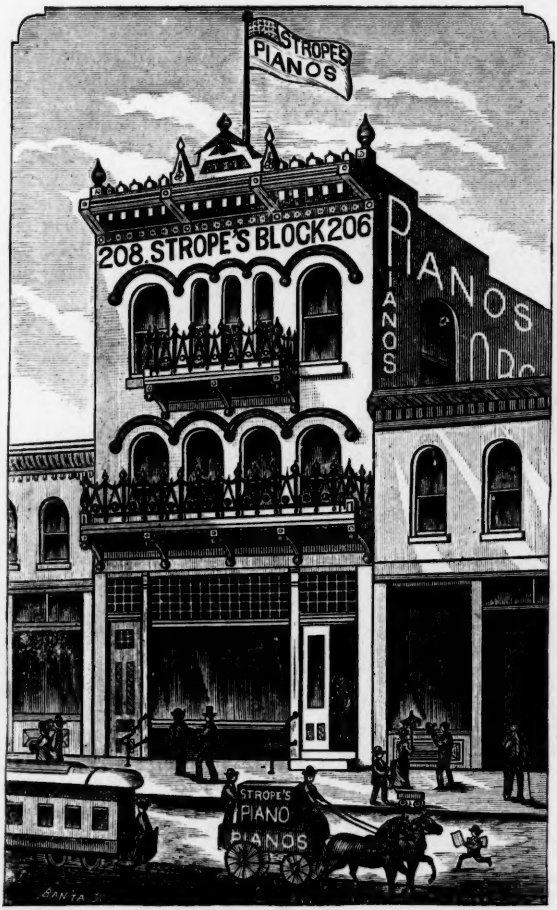

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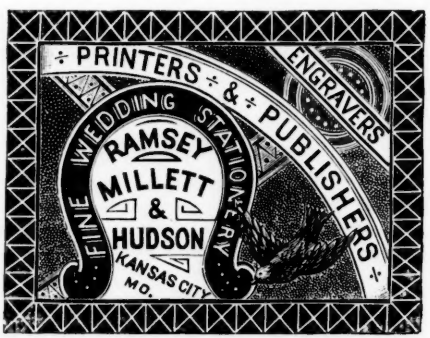

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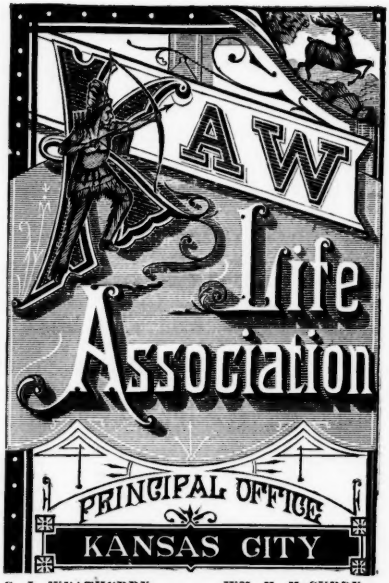

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VOL. VII. NOVEMBER, 1883. NO. 7.

PROCEEDINGS OF SOCIETIES.

THE MUSEUM OF NAPLES.[1]

ERMINE CASE, JR.

It is not to be wondered at, that the average American comes to have a pretty low opinion of that sort of institution denominated a museum, and naturally recurs to the type which has a hand-organ at the front door, and a stuffed mermaid on the staircase. The museums of European cities are somewhat different—not being confined to curiosities and by no chance ever containing monstrosities. A museum there may be only a gallery of pictures—possibly a collection of statuary.

Ordinarily, however, the word is used to designate a general collection of works of art—in oil, marble, bronze and plaster, archæological objects, ceramics and gems, coins, and books, prints, autographs, and illuminated mediæval missals, tapestries, curious carvings and relics of historical personages.

These collections are most usually owned by the government—sometimes by the cities in which they are situated. They are preserved in immense fire-proof structures, architecturally accurate. Costly too, in a degree we have no measure for even in our capitol buildings. However, in point of cost, these ornate buildings and extensive grounds bear no comparison to the value of the articles which constitute the museum.

I feel free to estimate the building which contains the British Museum, and

1 Read before the Kansas City Academy of Science, September 25, 1883.

its grounds in the heart of London, to be vastly more valuable than the grounds and Capitol building of the United States; while its contents range still higher, especially during sitting of Congress.

There are seven of these grand collections in Europe that are entitled to especial pre-eminence. The British, before mentioned, especially eminent for its archæological remains, of which there are some acres—notably the Elgin marbles—for its geological, mineralogical, and zoölogical cabinets; its library, unrivalled so far as English books are concerned.

The Louvre in Paris, which is even more magnificently housed, and more elegantly surrounded. This museum is, considering all topics, the most valuable in the world.

The gallery at Dresden, first among collections of paintings. The Pitti and Ubizzi Palaces at Florence which contain in mediæval paintings and antique statuary together the most famous gathering.

The Vatican, first in statuary and Roman, Grecian and Egyptian architectural remains, containing also a half dozen of the very first of paintings.

And sixth the Museum of Naples.

These collections are carefully and scientifically catalogued by men of great learning in the specialties which their museum covers, and one may see these grey old *savants* slipping about the corridors in big felt slippers and silk skull caps, now carrying a precious fragment of some Theban temple, or studying a cast of a far-off cuneiform inscription, surrounded by old tomes and charts, and now pointing out to some congenial, slippered and skull-capped scholar a newly arrived bone of Saurian from Nova Zembla or Arizona.

In several particulars the Museum of Naples is more especially unique than any I have specified, containing as it does the excavated treasures of Herculaneum and Pompeii, of Stabiæ and Cumæ. These are simply unrivalled in all the world. Here we have the household effects of a populous city, hermetically sealed by the ashes of Vesuvius, during the storms and tempests, during the wars and improvements of eighteen hundred years.

In order to emphasize the intense interest that gathers about the treasures excavated from these buried cities, let us for a moment contemplate the Rome of the Cæsars preserved to us by such an accident as befell Pompeii. Here again, there is the Forum with its surrounding temples of marble, decorated with that army of living marbles, rifled from Greece, Egypt and all the eastern world; possibly a pilaster still holding the skull of Cicero, or some one of his successors. Here are the triumphal arches, carved with victories from York to the third Cataract. Here is the colosseum not yet unrobed of its marble veneering; the golden house of Nero and his statue one hundred feet in colossal height. Here are the golden chariots and the gorgeous armor of the imperial legions. Here is the Circus Maximus with its 140,000 seats. The Fora of Augustus and of Trajan. The walls, the gates, the battlements, the unbroken arches of the eleven aqueducts stretching yonder to the Alban Mountains across the Campagna, among the unruined tombs of emperor and conqueror, of warrior, historian and poet; aye,

and by the entrance to those catacombs where the early Christians held their secret worship.

So too, we should have the interior of the dwellings of the emperor, the nobleman, the rich citizen, and the plebe. How many of those good Romans would our modern enthusiast of science be willing to know were smothered eighteen centuries since, in order that he might see imperial Rome in the grandeur of the first century. The countenance of that enthusiastic member of our Society who digs unweariedly in the mounds along the Missouri—methinks I see it light up with a sort of scientific joy as he discovers the crumbling bones of a possible prehistoric man, lying amidst his wretched arrowheads and potsherds. What, then! Could he find the skeleton of Augustus, mayhap under the shadow of the unstripped Pantheon, lying on his golden chariot, the skeletons of whose horses there lying, with gilded hoofs and brazen trappings. Around him would be found all that Greece had gathered from the world and Rome had brought from Greece.

This may never be. Five hundred years of war, and five hundred of robbery, left Rome what it is still—a dismal Italian city, with ruins so utterly ruined as to barely suggest to the imagination what the ancient city might have been; the works of Praxiteles turned to lime.

Let us turn, then, to the Museum of Naples and learn what the volcanic scoriæ of A. D. 79 did for the nineteenth century. I find I cannot write of this collection without trying in a measure to reproduce the atmosphere of the place. I believe environment is recognized as an influential element in all scientific matters. We will suppose that you have come out of your hotel on the Chiaja on a warm January morning; that you invested five cents in rose buds and orange blossoms with the black-eyed flower-girl in the vestibule, and that you stand on the steps a moment to look out on the famous bay, now curling with blue (they are very blue) waves. You see a dozen orange-colored sails of fishing boats—a steamer just starting for Alexandria—and a three-master coming in from the Golden Horn. Just at that point you find five yelling, whip-cracking cabmen roaring at you from the gutter, a coral-girl hanging her strands on one arm and a beggar with a colossal sore at the other. You will take refuge in a cabriolet and drive off up the long ascending slope of the Toledo, teeming with humanity as no other street. Arriving at the Capo di Monte, half a thousand feet above the shore, the whole of the magnificent bay of Naples lies before you. There is no other such view, I believe, on this earth.

Vesuvius you will necessarily notice first, for the volcano is close at hand, and its fire-stained black plume is floating just over you—its vineyards and olive orchards extending right up to the line of black lava of 1871. You cannot see Pompeii for it is opposite the mountain, but the site of Herculaneum is marked by the town of Portici, built upon the sixty foot bed of lava that still holds the greater part of its treasures. Around the entire bay sweeps a line of mountains, with the white towns clinging to their sides. Castlemmare, over buried Stabiæ and Sorrento. In the dim distance are the islands of Capri and Ischia. It is, however, the western shore of the bay that appeals most warmly to the classical

scholar. In a warm and sheltered nook was Baiæ, the most magnificent watering-place of the Cæsars, and where Cicero, too, had a villa. Now all is ruin, save the sunshine, the balmy air and the view of the bay entire. Only a mile along the coast and there is Lake Avernus, with a good, honest smell of sulphur. There is the Sibyl's Cave; there flows the literal Styx. Along this coast many of the labors of Hercules were performed. Here was Cumæ, which has contributed many superb statues to the museum. Here at Puteoli Paul landed and began at this terminus of the Appian way his journey to the judgment seat of Nero. Here is pointed out the tomb of Virgil, and we need not inquire too closely as to its authenticity. Suppose it was built in the sixteenth century, have we not created busts of the same old poet 300 years later? So then we have the atmosphere of natural beauty, of antiquity, of sculpture, of poetry, and may descend to the scores of enormous halls which hold the remains of this most interesting region.

Classifying in the order of those topics to which I shall give the least attention, we come first to the library. Though not a notable collection, there are over 200,000 volumes and 4,000 MSS. Among them are rare MSS. of antique date—missals illuminated by the masters, and some rare first editions. After all, a library cannot be described and must not be enumerated. One is never able, however, to enter one in the old world without finding something curious and unique. In this at Naples the chief attraction for the curious traveler is the library of Papyri—being some 1,800 rolls of MSS. on papyrus written in Greek. They were found in a carbonized state among the ruins of Pompeii. German scholars have been engaged years in deciphering them, but with no very valuable result.

Next in order will be the gallery of paintings. In respect of works of the old masters it is by no means rich, and yet nearly all are represented by several specimens. One must speak of these galleries of pictures relatively. In Italy this collection is fifth rate, while the city of London would pay any designated sum for it, as with all their wealth the English have been able to obtain no very good works of the Italian masters. Napoleon accumulated a large number for the Louvre as he was going about Europe on other business. Although there are some two thousand pictures here, and among them the usual assortment of Raphael's, Correggios, Guidos, Carraveggios, and Tintorettos, there is no one picture so pre-eminent as to have a world-wide reputation, but were there many they could not be depicted here. Only the technical features of a painting can be described, and then only to an artist by technical terms. No books are so tedious as those which posture and exclaim before the works of the old masters. It is very hard in a practical city like this—exclusively utilitarian in its pursuits—to understand what a hold art has upon the intelligent people of the old world. Not simply nor chiefly that they love to look upon a picture or a statue as mere decorative articles cleverly representing interesting subjects. Art is given a high place in education. It is made an instructor, historical, technical, archæological, anatomical, mythological. Educated men, in Europe, all know its principles, its methods, and its schools. They arrange themselves definitely as the disciples

either of the pre-Raphælite or the renaissance, just as aggressively as we are for or against a metal currency.

Next we come to the collection of statuary, probably the very best in Europe, as it includes many specimens of the very highest order, preserved to us in perfect form by the ashes of Vesuvius, and not with broken noses, dislocated ankles, and armless trunks, so common among the statues of northern collections.

The most productive quarry of statues at Rome has been the moat outside the old walls from whence they were thrown as missiles upon the invading Huns.

Here, at Naples, is a league of corridors filled with heathen deities and busts of Grecian and Roman emperors, consuls, famous soldiers, orators, and poets.

One comes to have a personal acquaintance with many of these marbles by their attributes. Here is a Minerva with her helmet; a Hebe with her cup; a Mercury with winged sandals. You know old Hercules by his muscle and his club; and Æsculapius by his staff entwined by a serpent. Here is a Venus, she has no attributes; she left them at home with her clothes. Fauns and Satyrs abound—half human, but wholly animal. Indeed it is from these marbles that the modern world obtained its idea of the Gods of the ancients. From these and a scant literature we have reconstructed their mythology, drawn our poetical figures, and our highest ideals in the art of sculpture.

It is certainly most curious, not to use a more discouraging term, that we are not now able to make a copy of a few of these noblest sculptures; only the plaster casts are fully equal to them. One is almost disposed to complain that they were ever discovered, then we should have been satisfied with the great mass of ancient and modern sculpture. But there stands this living dozen and the rest are stones.

So it is with the bronzes. Those that were exhumed from the ruins of the buried cities are the finest known. They too evince the inimitable grace of the Greek art. There are many large rooms filled with them, and they seem untarnished by long centuries of exposure to the wet soil.

There are those here who have had experience of the fragile character of the plaster on our western houses. They will be interested in the article produced by the builders of the first century. One of the methods of decorating a family residence in those days was by painting in fresco, and this was done upon the plastered walls. Fortunately for the preservation of this painting, now bearing the greatest antiquity of any extant, the plaster was not only able to bear the terrific shock of centuries of earthquakes; and withstand the drouth and moisture of the soil which pressed against it, but also after being exhumed, bore the process of being sawn from the walls in sheets, and carriage to the museum, where it now lines the sides of many large rooms. These frescoes are all light, graceful and fantastic. They are of brightly colored fruits, flowers, and birds—of bacchanals, nymphs, and fauns, of dancing figures, and cup-bearing Hebes. All are intended to delight and make life merry.

I have said that they are the oldest paintings now in existence. In all the ruins of Athens not one picture has been preserved. Here and there are famous

buildings are traces of color, showing that at one time they were decorated with paintings. Here then at Pompeii, in Greek painting, is an invaluable commentary on the methods of decoration, that were certainly in vogue in Athens and the Piræus. Only here can we learn how different was Grecian taste from that of the fifteenth century, when the old masters filled the churches with crucifixions, dolorosas, adorations and madonnas. I can only suggest the value of these paintings in showing the customs, in Græca Majora during the first century. We must pass to other rooms equally interesting.

In a long series of great rooms are preserved the articles in domestic use. There are many thousands of them, and yet a plain catalogue of them is interesting reading, or would be, had one ever been made. None has.

In the first place is a large model of Pompeii as it now exists. I estimate it to be forty feet in diameter. It is made upon a scale of exact proportions. Every street, every temple, every residence, or wine shop; every broken wall, every shattered column and broken fountain; every sentry box or amphitheatre. Whenever a building is newly excavated, its counterpart is placed here. Had the furniture of a modern house been subjected to the test these have, little would have been left but the casters of beds, and tables, and broken chairs, but here are bronze beds, bronze tables, bronze lamps, candelabra and dishes, and in the forms of these brazen articles we see the Greek taste that required ornament and lines of beauty in utensils of the most common use. Here is a frying-pan whose handle terminates with a fleur de lis, or a guelder rose, and of a bronze that has perfectly defied all these centuries; a candelabrum from the villa of Diomedes ornamented by a Bacchus riding a panther. Lamps with a standard representing an Ionic column. Hundreds of lamps are scattered through all the collection—all are different in design; all are tasteful and unique, but none of them are adapted to furnishing a light. A rag in a tin cup of oil is the pattern so far as practical use is concerned. No wonder the ancients were afflicted with ophthalmia. We read wonderful stories of elaborate dinners extending deep into the night, of perfumed lights and other similar etcetera. The lamps of Pompeii give these stories conclusive contradiction. A few small dull sheets of glass are shown, but windows are as scarce in Pompeii as in the catacombs of St. Calixtus. So we reason that these merry Greeks lived in the open air of their sunny clime, and so also did their Roman imitators, and made hay while the sun shone; that theatrical displays and gladiatorial games were held in the daytime. Further supporting this idea about light is the fact that each house of any pretension was built around an open court, which was surrounded by galleries. There are a number of other articles in glass, such as vials for medicine, and tear-bottles. I believe there is but one chair in the collection; however, there are many couches, and lounges, such as were used during their protracted dinners. These are often daintily decked with horses' heads, swans, limbs of beasts of prey—of course all in bronze. There are knives, forks, steelyards, a cooking-stove, kettles, pans. We have invented little in kitchen furniture since then—possibly explosive stoves.

A race of plumbers died at the destruction of Pompeii, for in the museum is a water-cock that has held water ever since.

There is a great room filled with cases of jewelry in gold, chains, necklaces, brooches, bracelets, rings, cameos, intaglios, gems, musical instruments, surgical instruments, and weapons. All of them richly wrought in designs, still the models of our best workmen. Vases, goblets, spoons, buckles, combs, silver-plate of many patterns.

I must conclude with what is perhaps the most beautiful part of this museum. The collection of vases. It is the most extensive and valuable in the world. Seven very large rooms are filled with them. The period of their manufacture is believed by the best authorities to have been shortly after the time of Alexander the Great. They are made of ordinary pottery and are usually of the shape of what we call urns. They vary in size from a common wine-glass to a height of six feet. Their great value lies in the historical cartoons with which they are decorated. From them the classical scholar obtains the illustrations of his study. They are done in brilliant colors and show the most vigorous action. The mention of a few of the subjects will give an idea of the value they are to modern scholarship. Perseus releasing Andromeda. Electra and Orestes mourning at the tomb of Agamemnon. Condemnation of Marsyas. A Battle between Greeks and Amazons. Marriage of Bacchus and Ariadne. Hercules pursued by Apollo. Bacchanalian Sacrifice. Achilles with the body of Hector. Darius planning the Conquest of Greece. Rape of the Golden Fleece. Ajax and Cassandra. Artemis in a Chariot drawn by Stags. Here we have, vividly illustrated, all important matters of ancient Grecian life. Marriages, funerals, battles, races, sacrifices, costumes, vehicles.

From them, and them only, we can illustrate the writings of Homer and Virgil. It is impossible to estimate how much has been added to our knowledge of antiquity by the articles in this museum.

From a tripod upon which sacrifices were made we have a chapter of history. From the iron stocks, found at the barracks of the gladiators, near which three skeletons were found, we have another. We know that the tradesmen advertised, for upon a charred loaf of bread, of the same shape now used in country families, is the name of the baker plainly stamped. They were gamblers, for here are the dice. They drank deeply, for amphoræ for holding wine are numerous and capacious. For the ladies there are mirrors, combs, perfumes, and even cosmetics. There are tools for the mechanic, implements for the farmer. There are locks to keep out thieves, bits for horses, hinges for doors, inkstands and styles for the scribe. In fact from the innumerable objects we find that these people of the first century had about them a vastly higher realization of art, than we of America have now. That their temples, their theatres, their parlors, and their tombs were most richly decorated; but that they had no windows, no bed chambers, no pleasant, private domesticity.

Let us examine this collection for a moment, with a view to the changes that have taken place since it was hermetically sealed up for us by the kindly ashes of

the volcano. Heathen Greece went over into heathen Egypt and brought back the graven deities; taking from them her first lessons in art, but the Gods of Egypt became not the Gods of Greece, but came to decorate her architecture and give ideals in conventional forms. In time Heathen Rome crossed over to Greece and brought back at the wheels of her war chariots an army of living marbles to decorate her capital and to decorate Pompeii, and other fashionable watering-places. And again came the Goth and Vandal southward to Rome, and heeding neither art nor deity, destroyed forever all that was typical of the high civilization of the era of the Cæsars. Meanwhile ashes and pumice and lava, had covered Pompeii and Herculaneum, Cumæ and Stabiæ, and when at the end of eighteen hundred years they were exhumed, heathen worship had passed from among civilized nations. Jupiter and the lesser divinities found themselves illuminated by the white light of scientific investigation and not by the lurid torch of incense, burning priests or by sacrificial fires. They were still the highest achievements in the art of sculpture, but they were no longer Gods. Artists and archæologists, antiquarians, and expert critics go there to study, but the day of their sanctity has forever passed away.

It would have been easier for me to have written much more than I have, than to have attempted to make typical selections as I have. If I have succeeded in giving an idea of the extreme value and unique character of this great collection, I must be content.

PHYSICS.

ELECTRICAL PHENOMENA IN THE ROCKY MOUNTAINS.

GEORGE H. BOEHMER.

In June, 1873, the Chief Signal Officer of the Army ordered the erection of a station of observation on the summit of Pike's Peak, Colorado, the establishment of which became entrusted to me; and while engaged in the execution of this task I had occasion to observe some electrical phenomena which, in consideration of the altitude at which they were observed—an altitude at which thus far very few, if any, observations on the subject had been made,—are supposed to be of sufficient interest to justify their publication.

In addition to my own observations—terminating in December, 1873—I have collected from the daily journals kept by the observers stationed at Pike's Peak until the close of the year 1880, with permission granted by the late General Albert J. Myer, all the facts bearing upon the subject, giving them in the exact language of the respective observers and without venturing to discuss them and offering only a few explanatory remarks on my own observations.

The proper execution of the work—the construction of a trail of approximately seventeen miles in length, which, starting from the foot of the mountains at an elevation of about 6,000 feet, had to be located in accordance with the topography of the mountains, and which was followed immediately by a telegraph line—rendered it necessary to change our camp often, thus causing a frequent changing of one terminus of the line while the other was permanently located in the office—Colorado Springs—at the foot of the mountains.

The battery employed for the purpose, being located in Colorado Springs, was of sufficient strength to successfully operate double the distance, and of its efficiency I was fully convinced, having had occasion to test the same repeatedly.

While camping in the lower regions of the mountains up to about 8,000 feet elevation, the signals arrived at either terminus of the line perfectly intelligible, yet, I noticed on several occasions that they were much more precise and marked at the lower station (Colorado Springs). I was at first puzzled to find a solution for this occurrence, but when, notwithstanding the most careful selection of a ground-connection, the intelligibility of the electrical signals received in camp, diminished with increase of distance and ascent into the higher regions of the mountains until, at an elevation of 11,500 feet (the timber line of the Rocky Mountains) not any were received in camp, while those sent down arrived in Colorado Springs plain and sharp, it appeared to me that such irregularity might be ascribed to the following cause:

The electricity left Colorado Springs at the positive pole of the battery; therefore, when the signals sent from that place did not reach camp at all or only indistinctly, it may be supposed that on such occasions the state of the atmosphere was highly negative electric, and thus resulted in the partial or entire neutralization of the voltaic electricity, while in sending down from the negative pole, a stronger current was produced by the consolidation of the atmospheric and voltaic electricity, both being negative.

Another phenomenon which came to my personal notice—though being felt more than seen—taught me a rather severe lesson.

After the passage of a very severe storm which had been raging in the mountains for several days, not any electricity, could be perceived in my line and even that sensitive electrometer—the tongue—failed to recognize its presence, thus indicating a break in the line, and which I found to be at an elevation of approximately 9,000 feet.

The day set apart for the repairing of the damage proved to be misty and rainy. Expecting a slight shock in making the connection I protected myself to the best of my ability, but the shock received upon ***nearly*** joining the two ends was such that upon twice repeating the experiment without success, my arms were rendered absolutely useless and pained me for a whole day. A few days later, on a fine and clear day, not any difficulty was experienced in making the desired connection.

In August, 1873, while spending a few days in my office, in Colorado Springs, I noticed, during the passage of a heavy thunder-cloud, a very interesting phe-

nomenon. The self-registering apparatus attached to Robinson's anemometer suddenly, and without the application of an electric battery, commenced registering the velocity of the wind, which at that time was blowing quite briskly.

The most interesting phenomenon, however, I had an opportunity to observe on the very summit of Pike's Peak, during the occurrence of a severe thunder-storm, probably 3,000 feet below our feet. On this occasion my party became somewhat alarmed at the effects of the atmospheric electricity upon men in producing an itching sensation in all extremities, a crackling noise, slight nausea and a humming noise, somewhat resembling that produced by the swarming of a hive of bees. On this occasion I recalled a certain experience I had in 1871. At that time I was in charge of the meteorological station in Leavenworth, Kansas, and had established my office on the third floor of a very tall house, the roof of which was covered with tin. On the roof I had placed quite a number of instruments, among which was a wind-vane with telescopic rod, the lower end extending to the ceiling of my room, where a gilded arrow, connected with the rod indicated the direction of the wind. The elevation of the upper extremity of the rod, ending in a gilded point, was about twenty feet above the roof. Quite frequently I had noticed, while sitting at my desk, and most especially during the prevalence of thunder-clouds, a peculiar, singing noise, which I then compared to that produced by swarming bees, without being able to detect the cause of the noise. At one time, however, being employed on the roof, in making repairs to some of the apparatus, my attention was drawn to this singing noise proceeding, apparently, from the iron structure of the wind-vane. Upon applying my ear to the rod I could plainly and distinctly hear this sound. Now, in placing the telescopic rod in position I had observed a gas pipe in close proximity, I removed a portion of the ceiling and by means of a copper wire made a connection with this pipe—and indirectly established a ground connection—and from that time I failed to notice the recurrence of this noise, although I paid the closest attention during the entire next year, the last one I spent in that office.

While thus employed in comparing the peculiar sound I extended my finger towards one of my companions and instantly a spark was seen to pass over. The hair on our heads stood on end, and a diverging position was noticeable in the hair on the tails of our horses, which we had left standing about seven feet off. Bits of paper which I threw into the air became attracted by the horses and attached themselves firmly to their tails. A discharge from the clouds restored the equilibrium, but the phenomenon repeated itself several times during the next ten or fifteen minutes, the duration of the thunder-storm.

ABSTRACTS FROM THE JOURNAL OF MR. R. SEYBOTH, FOR 1874.

January 5.—Humidity increased during the day and reached saturation at night, although the weather was nearly clear. The line worked badly all day. I could plainly hear the (Colorado) Springs calling me but could not break until night.

January 31.—From some unexplainable cause the afternoon report was de-

layed several hours, the line being open but commencing to work again without either summit or base station having made any repairs.

February 28.—About 8 A. M. I heard some one calling me very indistinctly, it sounded as if the wire had been cut and some one was trying to send by working the two ends of the wire. I asked him to repeat and he sent back "answer again" which were the only words I could understand.

The afternoon report was not taken at Springs—probably line worked too poorly—neither did I hear Springs call me up when it was time.

March 1.—Line worked miserably through the afternoon, so that I could not break the Springs. At night line worked better.

March 11.—Line went down at 7 P. M., but got all right again on,

March 12.—at 8 A. M.

March 29.—Line opened at 7 A. M. Found no break. Line worked again at noon and operator from below on trial, said that he found no break, but that he had no current on the "Lake cabin," although he had put on a ground at that place.

(It may be mentioned here that the line is patroled from above and below, the rendezvous being at an elevation of 9,000 feet, where, on the shores of a lake —"Mystic Lake"—a cabin has been erected to afford shelter to the repairer.)

Special remark by the observer: The difficulty in communicating with base station increases as the weather grows milder. For a great distance below timber line the wire is imbedded in snow.

April 6.—The line worked miserably all day, and I could not communicate with base station unless the Denver battery was in circuit.

April 15.—Line worked too poorly to send the afternoon reports, and opened entirely in the evening.

April 16.—Line open all day. I walked quite a distance down, but found no break. The task is almost a hopeless one, as the snow hides poles and wires in many places.

April 30.—The base has much difficulty in reading my signals, even in dry weather.

May 21.—Thunder-storm, hail, and sleet. A flash of fire, about two feet long leaped from the lightning arrestor into the office, illuminating the rooms, but doing no damage.

May 24.—Heavy thunder-storm passed slowly and directly over the Peak from 10 A. M. to 3 P. M. The temperature declined during the passage, and large sparks passed constantly through the lightning arrestor, while a strange crackling of the snow could be heard at times.

While making the 2 P. M. out-doors observation I heard the snow crackle as before and at the same time I felt on both temples—directly below the brass buttons of my cap—a pain as if from a slight burn. Putting up my hands, there was a sharp crack and all pain had disappeared.

May 29.—A violent thunder-storm accompanied by heavy sleet passed over the Peak from S. SE. to W. NW. It came upon us so suddenly that I had barely

time to cut out the telegraph instrument, before blinding flashes of fire came into both rooms from the lightning arrestor and stoves. At 7 P. M. a bolt struck close to the north window, and at the same time a heavy discharge took place through the lightning arrestor, which made me, for a moment, believe that the building itself had been struck and was on fire. A cloud of smoke filled the embrasure of the north window, which was afterwards found to have resulted from the melting of the rubber insulator on the office wires.

The lightning arrestor was badly burned, and the line did not work that night; very likely the wire has been burnt outside.

June 1.—Line worked poorly.

June 5.—Heard Boutelle (operator on the trail) call base and summit, apparently from some point of the trail, but could not break.

June 6.—Line worked so poorly that I could not raise base at night.

June 10.—Line open; apparently no break.

June 18.—Much lightning passed through the arrestor, although I had the line wire connected outside with the ground wire.

July 1.—Heavy thunder-storm and sleet in the forenoon. Visitors caught in the storm said that they all experienced peculiar burning sensations on face and hands, and heard hissing sounds proceeding from their hair and whiskers.

July 9.—Heavy thunder-storm SW., from 3:30 P. M. to 4:15 P. M.; heavy sparks through lightning arrestor.

July 14.—Thunder-storm. I received a very painful shock while working over the line, my fingers accidentally touching the metal of the key.

July 16.—Heavy thunder-storm. Sharp flashes and reports came through lightning arrestor to the terror of several lady visitors. Outside, the electric effects were still more startling. The strange crackling of the hail mentioned before, was again heard, and at the same time my whiskers became strongly electrified and repellent, and gave quite audible hissing sounds. In spite of the cap I wore, my scalp appeared to be pricked with hundreds of red-hot needles, and a burning sensation was felt on face and hands. Several of the visitors, outside, experienced the same, and a large dog out doors became terrified and made for the door with a pitiful howl.

July 19.—Lightning struck the wire, and for a moment the wire resembled a rope of fire and vibrated violently for some minutes after the discharge. No damage. Frequent loud discharges took place along the ground wire, between it and the rocks on which it rests. Hair and beard of any one out doors were electrified by each discharge.

July 21.—Heavy discharges through the lightning arrestor, and although I had opened the key, the lightning jumped the space and worked the relay until I took all the wires off.

July 22.—Received heavy shock while attempting to send a message.

August 13.—Visitors became electrified.

August 17.—Continuous ground currents through the lightning arrestor.

August 22.—Visitors electrified.

ABSTRACT FROM THE JOURNAL OF MR. THOEDOVIUS.

October 5.—Thunder-storm. Received severe shock while endeavoring to call base station.

ABSTRACTS FROM THE JOURNAL OF MR. J. V. BROWN FOR 1875.

May 24.—Hail. Electricity; at times the office filled with it, while sparks from the lightning arrestor filled the room with sulphurous smoke. Lightning struck wire near the house, nearly knocking observer down. Amount of electricity increased and decreased with increase and decrease of hail, which fact is noticeable in all our storms.

May 29.—Hail with electricity. I notice that in all our hail-storms the fall entirely ceases for about half a minute following a heavy electric discharge, and that the hail-fall is considerably heavier for some little time following the discharge than before.

July 5.—At noon, electric storm with hail. At first its effects were felt or seen on the line, but at 2 P. M. its presence was felt on the summit. From the lightning arrestor there was a constant stream of flame, filling the building with sulphurous smoke. Out of doors it was even worse. There was a constant crackling noise in the air as though it were by pistols.

July 26.—Electricity has been very strong all day, at times stopping communications with the base station.

July 27.—Atmospheric electricity was so strong that signals could not be sent this afternoon.

August 9.—Atmospheric electricity very strong.

October.—Atmospheric electricity through lightning arrestor. Instruments appeared on fire.

December.—Line from summit to timber line covered with snow works excellent; it seems that it works better; but if the line but touches the ground below the lake it goes into bankruptcy at once.

ABSTRACTS FROM JOURNAL OF MR. CHARLES M. HOBBS FOR 1876.

January.—Difficult to keep the electric self-register of anemometer.

April 24.—Almost clear sky. Lightning. The presence of electricity in the air was also manifested by a continual crackling at the lightning arrestor, but I had no difficulty in working the instrument.

April 31.—Replenished the main line battery this afternoon. After I had made the proper connections I could get no current from the Springs and have had none up to the present writing.

May 11.—Thunder and hail. Was compelled to cut out the wires owing to the intensity of the electricity. I attempted it with an ungloved hand and in so doing learned a lesson that was an impression at once. Luckily I escaped with a slightly bruised head.

May 24.—At 6 P. M., thunder and lightning west and southeast of Peak. One bright, long flash leaped out of lightning arrestor, which was continually

making the usual crackling sound. About this time, while I was out doors, I heard a peculiar "singing" at two or three places on the wire; when I approached near one of these places the sound would cease but would recommence as I withdrew two or three feet. Thinking at first that the wind might possibly make the noise, though it was only between six and seven miles an hour, and that I cut this off when I approached the wire I stood at a distance and advanced my hand on every side and above and below, but the effect was always the same, the noise stopping when my hand came near the point and recommencing when it was withdrawn.

June 16.—At 5 P. M. as I was sitting on a rock a blinding flash darted from a cloud, succeeded by a quick, deafening report, and at the same time I felt the electricity darting through my entire person, jerking my extremities together as though by a most violent convulsion and leaving a tingling sensation in them for a quarter of an hour. An assistant who was sawing wood in a shed received a similar violent shock, and said that a ball of lightning appeared to pass through the store room and wood-shed, leaving a strong sulphurous smell.

June 17.—Found lightning arrestor at lake house badly burned by yesterday's lightning, making a ground connection.

June 27.—Very decided electrical displays occurred all the afternoon and evening, and many vivid sparks came into the rooms on the wire.

June 28.—Vivid flashes almost constant from 3 to 7 P. M. Bright flashes were of frequent occurrence in the room and the crackling noise in the lightning arrestor did not cease for a moment.

July 13.—Near sunset the peculiar singing noise on the wire previously spoken of was heard very distinctly, and it also seemed to come from the surface of the instrument shelter and house as well as from the wire.

July 23.—Rain-storm with electricity. The anemometer stopped working on account of the electric storm.

July 31.—Rainy day. Could not get the base station.

August 6.—Atmosphere highly charged with electricity. Anemometer stopped working on this account.

August 18.—Mention was made previously of singing noise in wire. To-night it was not only heard, but the line for one-eighth of a mile was distinctly outlined in brilliant light, which was thrown out from the wire in beautiful scintillations. Near us we could observe these little jets of flame very plainly. They were invariably in the shape of quadrant and the rays concentrated at the surface of the line in a small mass about the size of a currant, which had a bluish tinge. These little quadrants of light were constantly jumping from one point of the line to another, now pointing in one direction, and again in another. There was no heat to the light and when I touched the wire I could only feel the slightest tingling sensation.

Not only was the wire outlined in this manner, but every exposed metallic point and surface was similarly tipped or covered. The cups of the anemometer appeared as four balls of fire, revolving slowly around a common center; the

wind-vane was outlined with the same phosphorescent light, and one of the visitors was very much alarmed by sparks which were plainly visible to us in his hair, though none appeared in ours.

At the time of occurrence of the phenomenon snow was falling, and I had previously noticed that the singing noise is never heard except when the atmosphere is very damp, and rain, hail, or snow is falling.

1877, March 30.—At sunset I heard on the wire the peculiar singing noise which was referred to several times last summer, and which was generally heard when the air was moist, very quiet and heavily charged with electricity.

April.—Foggy; snow in the afternoon and frequent crackling of the lightning arrestor.

May 24.—Wind, fog, snow, hail, and electricity. The electricity was strong during the day, and assistants and myself received severe shocks. The floor is saturated with water which has leaked through the ceiling and thus a connection is made with the battery and ground-wire, and under these circumstances there is more than usual cause to feel severe, if not fatal shocks of electricity.

July 27.—Electricity very intense. Could not send report.

ABSTRACTS FROM THE JOURNAL OF MR. WILLIAM BLAKE.

1877, August 6.—From 8:50 P. M. to 9:20 P. M., hail-storm accompanied by intense electricity. All metal objects tipped with sparks.

October 13.—Snow all day. During the afternoon the atmosphere was highly charged with electricity.

November 13.—Snow all day. Electricity appears to be very intense.

November 25.—At 7 P. M., brisk snow attended by very intense electricity, which could be heard crackling in a person's hair continuously, although there were no reports of thunder in the storm.

December 26 —Snow. Atmospheric electricity was very intense during day and at times would crackle on various objects in the room.

1878, January 25.—Severe thunder-storms in the afternoon in surrounding parks and gulches. The electricity on the summit was very intense, and there was a continuous snapping of the lightning arrestor.

March 6.—Westerly gale; temperature higher, and in the afternoon a beautiful display of cirrus. Atmospheric electricity was very strong on the summit during the day, and it was difficult to work the line on account of the passage of frictional sparks.

March 26.—Very intense electricity during the forenoon.

April 22.—Heavy thunder-clouds hung over South Park during the day and at times electricity very dense on the summit, without discharges, though incessant crackling on the lightning arrestor and in one's hair. No sunset report was made on account of the atmospheric electricity on the wires.

April 27.—Thunder-storm in the valley. Electricity very dense on summit.

May 12.—A snow storm occurred during the night and at 1 P. M. was drifting furiously by a rising gale. The electricity varied with the winds-gusts

and was so intense at times as to render our position exceedingly dangerous. The wires were cut out but violent sparks would still jump six inches between the disconnected wires. One violent discharge seemed to have occurred in the chimney, for a terrible commotion was caused in the soot and ashes.

May 24.—At 8 P. M., snow and severe electricity, very intense for an hour. Wires cut out and parted, and a vivid glaring was continuous in the windows. A lamp set in the north window would, with its flame, cast a shadow on the opposite wall for several seconds.

May 26.—Heavy clouds most of the day with intense electricity at times.

June 3.—Heavy lower clouds in evening. Air appeared to be highly charged with electricity.

June 5.—Snow from 1:30 P. M. to 2:30 P. M. being attended by severe electricity.

June 15.—Line worked hard on account of intense electricity and the storms below the summit.

June 25.—Hail from 3 to 4 P. M. Severe electricity. Wires had to be cut out and great danger was felt in the office. Intense electricity again in the evening from storms below the summit.

July 2.—Sleet from 2:55 P. M. to 7 P. M. with intense electricity. At 3:20 P. M. a violent lightning explosion occurred in room near stove, scattering the wood and knocking down the stove-pipe.

ABSTRACTS FROM THE JOURNAL OF MR. RUFUS CHOATE FOR 1879.

April 2.—Cloudy. Line working well. Can hear the lower station but cannot break.

April 10.—Line heavily charged with a ground current, and it was with difficulty that signals were got off. The current, at times, was entirely reversed.

April 12.—Snow storm. Electricity intense. Very brilliant sparks were jumping from the lightning arrestor all the evening.

April 23.—Telegraph line affected during the day by atmospheric electricity.

April 25.—Clear and fair. Line worked all right but could not raise the lower office by any means. It works through as I cut off the battery at this end and found a current strong enough to work the relay.

April 26.—Line works all right but cannot, by any means, break the lower office.

May 27.—Electricity on the wire interrupted the circuit at sunset. Sparks have been flying from the lightning arrestor during afternoon and evening.

ABSTRACTS FROM THE JOURNAL OF MR. JAMES K. SWEENY FOR 1879.

June 5.—Thunderstorms around near the Peak. Telegraph line affected by electricity.

June 16.—At 12:40 P. M. sleet, and at 1:10 P. M. thunder, but only a few peals were heard when it gave way to a strong, steady current over the wire, and from 1:15 to 1:35 P. M. one of those electric storms peculiar and common to

Pike's Peak prevailed. A queer hissing sound issued from the telegraph line, the wind-vane post and other posts standing in a deep snow-drift near by. I stepped out to view but was not standing in the snow-drift long when the same buzzing started from the top of my head; my hair became restless, and feeling a strange creeping sensation all over my body I made quick steps for the station. Once inside upon the dry floor the effect soon left me. After getting inside I opened the telegraph key and found a continuous bright spark passing between the key and the anvil, even when they were separated one-eighth of an inch, and by putting two thicknesses of writing paper in this space, it was scorched and perforated by numerous holes. By accident I completed the circuit with both hands when I received a shock that set me back on the floor. I then concluded I had had enough of experimenting.

June 29.—Atmospheric electricity was very intense. At 11:19 A. M. a ball passed through the arrestor with a report exceeding that of a rifle and threw sparks all over the office. It was followed in an instant by terrific thunder. The suddenness and violence of the shock stunned me so that it was a little while before I could realize what had happened.

ABSTRACTS FROM THE JOURNAL OF MR. EDMUND DAVIS FOR 1879.

July 10.—Hail storm with terrific thunder and lightning which constantly jumped from the telegraph instrument. On stepping to the door at 6 P. M. the assistant stated that he felt a peculiar sensation about his body, similar to that of an awakening limb after being benumbed, that his hair stood straight out from his head and served to produce a peculiar singing noise like that of burning evergreens. The telegraph line and all metallic instruments produced a noise like that of swarming bees. When he felt on his hat the prickly sensation became so intense that he was compelled to remove it, his forehead smarting as though it had been burned, for fully three hours after. At 7 P. M. the electric storm had ceased.

August 12.—At 5:40 P. M. a bolt of lightning went through the lightning arrestor with the report of a rifle, blowing a ball of fire across the room against the stove and tin-sheeting. The wood-packers, Messrs. Wade and McDonald, had taken refuge in the station for a few minutes but concluded immediately that this was rather an uncomfortable place during a storm, and left. Their dog, however, was far in advance seeking shelter outside. Mr. Wade declared that the lightning struck him in his feet and legs. At 6:35 P. M. the lightning struck the wire and building at the north and where the wires come through the window and lightning arrestor with a crash equal to any forty-pounder. It burned every one of the four wires coming in at the window, into small pieces, throwing them with great force in every direction and filled the room with smoke from the burned gutta percha insulation. The window sash was splintered and the outside pane of glass broken; another pane was coated with melted copper. The anemometer wires were also burned up and the dial of the anemometer burned and blown to pieces. A new anemometer was immediately put up, and within

three quarters of an hour the new one was working, but the electricity was still very intense.

Assistant Sweeny was nearly deaf for some time afterwards. One piece of the wire was thrown with such force that when it struck the barometer, three feet distant, it was wound around it without, however, doing damage to the barometer.

October 13.—Atmospheric electricity on wires to night.

November 19.—This forenoon a boiler lid was noticed to become charged with electricity, and would give off an unpleasant shock.

1880, February 9.—Clear weather, rising barometer and high winds. Telegraph line in bad condition and working poorly. Assistants Davis and Jones called repeatedly by Assistant Blake, but he was unable to raise the base station. Blake remained at the key for more than an hour adjusting and calling, but did not succeed in getting off the signals.

February 10.—Cloudy. Light snow during the day. Line working all right but it was impossible to break the lower station.

April 25.—Cloudy weather. Line working badly at 9:07 P. M. Signals sent with difficulty.

May 19.—Atmospheric electricity in the wire all day.

June 20.—From 6:50 to 8:35 P. M. very small discharges of atmospheric electricity. Line working very badly.

June 23.—Several light thunderstorms passed over and north of the Peak during the afternoon. At 7:10 P. M. a heavy snow storm set in accompanied by terrific flashes of lightning and heavy rolling thunder. Telegraph communication interrupted.

July 3.—Heavy electricity on the wire at midnight observation. No report sent, as each flash of lightning threw the instrument out of adjustment.

July 18.—Hail at 5 P. M. lasted until 7:15 P. M. accompanied by heavy shocks of electricity.

July 20.—Hail accompanied by terrific discharges. Atmospheric electricity quite prevalent during the evening and line working very poorly in consequence.

July 21.—P. M. Hail and heavy flashes of lightning which played around the lightning arrestor and exploded with great force.

July 23.—From 1:35 P. M. to 5:40 P. M. heavy rainstorm. Intense ground currents of electricity quite frequent during the prevalence of the storm.

August 3.—At 11:40 A. M. hail and terrific flashes of lightning which exploded with great force on the lightning arrestor and interfered with the working of the telegraph line.

September 10.—Hail from 1:40 P. M. to 2:50 P. M., accompanied by terrific discharges of electricity which for a time suspended all communication between base and summit and made telegraphing a very dangerous experiment.

October 26.—At 12:50 P. M. a heavy thunderstorm with light snow and sleet. Lightning passed constantly through the lightning arrestor with loud reports.

November 14.—Line working very weak this morning. Circuit is growing stronger toward noon.

ABSTRACTS FROM JOURNAL OF MR. J. P. O'KEEFE FOR 1881.

January 29.—Heard lower office call but was unable to break.

June 23.—Thunderstorm. Lightning snapped at the lightning arrestor and exploded with great force.

July 4.—Heavy thunderstorm. Lightning snapped on the lightning arrestor and exploded with great violence in the office. Several times during the evening I was certain that the station building would be struck and demolished, as the lightning was almost continuous.

HISTORY.

EXPLORERS OF WESTERN AMERICA.

G. C. BROADHEAD.

I. BRITISH EXPLORERS.—The main object of the Spaniards in exploring hitherto unknown countries was *gold;* that of the English, trade. For this purpose in 1669, the Hudson Bay Company was organized, including Prince Rupert and one hundred and seventy others. To this company Charles II, of England, gave and granted in fee as lord of the soil, all the territories on the coast and confines of all seas, lakes, and rivers within Hudson Strait, not actually in the occupancy of any other province or State, together with the sole and exclusive right of trading with all inhabitants thereof. The chief aim of Charles in this, was the discovery of a northwest passage. The trade of the company amounted to but little for a long time, and in fact was exceeded by that of the French in Canada, and quite a war raged between the rival companies. The charter of the Hudson Bay Company did not specifically limit their territory.

In 1774 the Northwest Company was formed. Among their chief men were MacKenzie, MacTavish, Frazier, Frobisher, and MacGillivrey. They soon became powerful, pushed trade to the Arctic Ocean, and in 1789 MacKenzie discovered the river bearing his name. In 1794 he crossed the Rocky Mountains and discovered Frazier River, and on the 25th of July reached the Pacific Ocean. In 1772 Sam'l Hearne, of the Hudson Bay Company, reached the Copper Mine River, and followed it to its mouth. In 1812 the Hudson Bay Company disposed of a tract of land on the south shore of Lake Winnepeg to Lord Selkirk, who started a colony there. This was resisted by the Northwest Company, and their agents and men actually warred against its settlement, killing some and in 1814 driving others off. These differences were brought to the British Parlia-

ment, and a compromise was finally effected in 1819, by which the two companies were merged into one. Since 1836 Selkirk's settlement has been revived, and is now known as Manitoba. At present the posts of the Hudson Bay Company are scattered all over British America, and up to about 1840 they had posts within the territories of the United States, in Oregon, and traded also east of the mountains. Within their posts and with their men, and toward the Indians their power is despotic. Their traders seriously obstructed the plans of the U. S. Companies and broke up John Jacob Astor's traders.

Beyond these companies there was but little exploring done by the British. Jonathan Carver, in 1763, visited the country west of Lake Superior and near the head of the Mississippi and published a valuable book which can yet be obtained.

II. AMERICAN EXPLORERS WEST OF THE MISSISSIPPI.—My chief object in this is to direct attention to those (now) rare books of explorations now difficult to obtain, in order that students may know what has been written thereon, especially "officially," and procure them if desired. I shall confine myself to the period from 1800 to 1850.

Previous to 1800 the U. S. Government had made several futile attempts at creating a trade with the western tribes, but it was left to the keen foresight of President Jefferson and the able assistance of Lewis and Clark to make the first bold strike. Meriwether Lewis and Wm. Clark led the first exploring expedition west of the Mississippi. The main plan of this expedition was conceived by President Jefferson, Meriwether Lewis being his secretary.

May 4, 1804, Lewis and Clark left their encampment at the mouth of Wood River opposite the mouth of the Missouri and passed up the Missouri. June 21st, they encamped at the mouth of Platte River. November 3d, went into winter quarters among the Mandans. April 9, 1805, they proceeded up the Missouri and on July 28th reached the forks of the Missouri at the junctions of Madison, Gallatin, and Jefferson Rivers. On the 17th of August they reached the extreme point of navigation. August 27th they proceeded through the mountains (Bitter Root) suffering much for lack of food, and ate horse meat. They passed down Kooskookie River, finding great scarcity of game. October 10th they reached the mouth of Lewis' Fork of the Columbia. November 1st they reached the Pacific and went into winter quarters, but were very much troubled by frequent torrents of rain. March 23, 1806, they set out on their return, Captain Lewis by way of the head of the Missouri, and Captain Clark passing up Clark's Fork, crossing over to and down the Yellowstone, joining Lewis, August 12th, at the mouth of that river. They reached St. Louis September 23, 1806.

Captain Zebulon Montgomery Pike, in 1805 made a partial exploration of the Upper Mississippi, but cold weather forced him to return.

On June 24, 1806, Gen. James Wilkinson, U. S. Commander of Upper Louisiana, issued orders from St. Louis to Capt. Z. M. Pike to accompany certain Osage captives to the Osage villages on the Osage River, and if possible to accomplish a peace between the Kansas and Osage tribes; also to establish a

good understanding with the Yankton and Comanches, (Panis, Kans, Arkansaw). On July 15th, Lieut. Pike left Belle Fontaine (a fort just above St. Louis). July 28th he arrived at the Osage River and passed up that stream. August 19th he arrived at the village of the Grand Osages (not far from junction of Marmaton and Little Osage River, and probably at or near present town of Papinsville, Bates County. The village of the Little Osages was probably where Balltown now is). September 1st he left the Osage Village and went west. About the last of September he held a council between Osages, Kans, and Pawnees, and was detained nearly a week. He then marched on westwardly up the Arkansaw River. On November 15th he came in sight of the peak of the Rocky Mountains since named in his honor, "Pike's Peak." November 25th he was still among the mountains and in sight of the Peak, and on December 3d he reached the foot of the peak. Pike's Peak he found to be 10,581 feet above the prairie below and he supposed the prairies to be 8,000 feet above the sea. In this he erred, for the Peak is now found to be between 14,000 and 15,000 feet above the sea.

Pike's men suffered much from the winter weather, as they were thinly clad and not prepared for winter; consequently they suffered from extreme cold and hunger, and some men were frost-bitten. The first part of December was stormy but game abounded. They struck a Spanish trail and reached the Rio Grande on December 13th, and passed up it for ten days, supposing it to be the Red River. It was then they suffered most from cold and hunger. They wandered around among the mountains for a month. On January 31st they built a stockade and prepared to winter on the banks of the Rio Grande. February 16th Mexican spies were seen, and on the 26th a troop of Spaniards visited them, and only then did they find out that they were on the Rio Grande and not on Red River. The Spanish troops took them to Santa Fe (as prisoners), reaching there March 3d. From thence they were sent off to Chihuahua, which they reached April 2d. All their property was taken from them. At Chihuahua they were detained until the 28th of April and then escorted east, reaching San Antonio the 7th of June and Natchitoches July 1, 1807. Captain Pike preserved some of his notes by placing them within a gun-barrel. Before reaching the Mountains Pike had sent Lieut. Wilkinson and some men in a boat down the Arkansaw. On May 3, 1806, a party under Captain Sparks passed up Red River to Natchitoches, and thence for 635 miles, but were ordered back by the Spanish authorities.

Washington Irving, in that charming book of his entitled "Astoria," has unfolded to us the many hardships and trials of the hunters and trappers in the (then) wilds of the Rocky Mountains. This book contains a full account of the travels and hardships endured by Wilson P. Hunt, agent of John Jacob Astor. Hunt was a native of New Jersey. In 1810 he prepared for his trip, but it was not until 1811 that he was fully upon his route. During December, 1811, and January, 1812, the company suffered the most extreme hardships while attempting to pass down Snake River and westwardly across the Blue Mountains. He reached Astoria in February, having traveled in all about 3,500 miles from St. Louis, although the direct route was much less. Mrs. Ann L. Hunt who died

in St. Louis a few years ago, was the relict of Wilson P. Hunt. She was the sister of the late James H. Lucas and very wealthy.

Many expeditions have been performed, replete with thrilling interest, and some of them have developed important geographical facts by the various trappers and traders between 1810 and 1850, but they have left no record. Volumes of the most interesting matter yet remain unwritten.

Major Steven Long, U. S. A., under orders from the Secretary of War, left Pittsburg, May 3, 1819; passed down the Ohio and up the Mississippi, reaching St. Louis June 9th. Thence his men marched partly by land and partly by water to Ft. Osage, reaching the mouth of Kansas River the 13th of August. From thence they passed across toward the Platte River, and wintered at Council Bluffs.

In 1820 Long again marched from St. Louis along and near the Missouri River, and country near the north line of Missouri, and on June 6th he left Council Bluffs and visited a large Pawnee village on Loup Fork of the Platte, and on the 6th of July he was at the foot of the mountains on Platte River, and ascended several mountains near Pike's Peak. The party divided, one party going down the Arkansas, but Long struck southwardly, reaching Red River on the 24th of July. He explored the country along the Canadian, from thence to Arkansas River, reaching Ft. Smith the 23d of September, and thence to Cape Girardeau by way of Hot Springs.

In the fall and winter of 1818–19, H. R. Schoolcraft journeyed southwest from Potosi, Missouri, through a then pathless and unsettled wilderness to White River, passed over to James Fork of White River and erected the first furnace and smelted lead, (on a log furnace), first in southwest Missouri. This was probably about five miles from where Springfield now stands. He then passed down White River to eastern Arkansas and back to St. Genevieve. The story of this journey was published about 1830 by Lippincott and entitled "Scenes and Adventures in the Semi-Alpine Region of the Ozark Mountains." A copy with a different title had previously been published in London.

In 1820 Schoolcraft explored the head waters of the Mississippi; also, in June, 1831, he visited the head of the Mississippi and discovered Itasca Lake. In 1821 Schoolcraft accompanied Gen. Cass from Detroit, southwest across Ohio, Indiana and Illinois to St. Louis, and again visited the lead mines of southeast Missouri. He then accompanied Gen. Cass to Chicago, where a treaty was effected with the Indians Several books were published as results, viz: "View of Lead Mines of Missouri," and "Account of Tour," also "Discovery of Head of the Mississippi."

An interesting account of the adventures of Captain Bonneville may be found in Irving's work; as that book is accessible to most persons, I will simply sketch his route. He started out in 1832 and returned in 1835. His route was up Platte River thence through Wind River Mountains, and down Snake River. At times the men nearly starved to death, as well as suffered extreme cold. One

party of his men made a trip from Salt Lake southwest to Monterey, California, and returned. Bonneville made two trips across the mountains.

General Atkinson made a trip up the Missouri River in 1825, but we have seen no account of it.

In 1835 Colonel Henry Dodge headed an expedition from Ft. Gibson to the Pawnee villages. In 1835 he also commanded eight squadrons of dragoons on an expedition from Ft. Leavenworth to the Rocky Mountains, visiting tribes and effecting peace among the Indians from the Arkansas to the Platte.

Nicollet explored the regions of the Upper Mississippi from 1833 to 1838; during the latter period he was assisted by Fremont.

In 1835 G. W. Featherstonhaugh made a geological examination of the country between the Missouri and Red Rivers. His report was published by authority of the Government, but is not of much value.

In 1838 Captain Canfield, U. S. Topographical Engineer, surveyed a route for a road from Ft. Leavenworth to Ft. Snelling.

Soon after this the Government started Fremont on his eventful expedition. In 1842 (then) Lt. John C. Fremont commanded his first expedition to the Rocky Mountains. Early in June he set out from the mouth of the Kansas River. His route was by way of Platte River to St. Vrain's Fort, Sweet Water River, and South Pass to Three Tetons and back to Ft. Laramie, and returned to St. Louis early in October.

May 29, 1843, he left the present site of Kansas City and passed over much of his last year's route to Ft. St. Vrain, Fontaine qui Bouille, and Arkansas River. He sent Fitzpatrick across to Ft. Hall, and he passed over Cache la Poudre River to the Black Hills, then crossed the Medicine Bow Mountains and the North Fork of Platte to Green River, and reached Great Salt Lake September 6th. Food had become scarce and the party had to subsist on a horse. He thence passed over to the waters of the Columbia River, reaching Fishing Falls of Snake River, October 1st, thence through the Grand Ronde, reaching the Columbia River at the mouth of Walla Walla River, October 25th, thence down to Ft. Vancouver. Partly retracing his steps he passed the Dalles, thence up Fall River and reached Flamath Lake the 11th of December, and Pyramid Lake the 13th of January. His men suffered extreme hardships among the snows of the Sierra Nevada, having to subsist mainly on famished horses and mules. Some of the party became crazed by hunger and cold; one was lost and another wandered off and was lost for many days. On March 6th the party reached Suter's Fort on the Sacramento, explored Stanislaus River and the San Joaquin to its head. Thence the route was across the Sierra Nevada to the Santa Clara Fork of the Rio Virgin, thence northeast to Sevier River, and reached Salt Lake the 24th of May. Thence via the Uintah River to Yampah, and on the 12th of June passed through South Pass and reached Kansas (City) the 31st of July. Without the aid of Kit Carson it is doubtful whether Fremont could have extricated himself from the terrible difficulties of his trip.

In 1845 Fremont accomplished his third expedition to the head of the Ar-

kansas, the Rio Grande and Rio Colorado and westwardly. Of this trip we have seen no official report.

Lieut. W. H. Emory performed a military reconnoissance from Ft. Leavenworth to San Diego, California, passing along the Arkansas, Del Norte, and Gila Rivers, reaching the Pacific coast in December. On the 6th of December Capt. A. R. Johnson was killed in a fight with the Mexicans at San Pasqual, California.

In November and December Col. P. St. George Cooke marched from the Rio Grande to Tucson and thence to San Diego, Cal. About the same time Lieut. J. W. Abert explored the country from Leavenworth to Santa Fe, returning by the Canadian and Arkansas Rivers. The reports of the various expeditions of 1846 and 1847 were published in one volume by the Government.

By authority of Congress David Dale Owen made geological surveys in 1847, 1848, 1849, and 1850 of country now included within the limits of Wisconsin, Minnesota, Dakota, and Iowa. In this he was ably assisted by Richard Owen, Dr. J. G. Norwood, Col. C. C. Whittlesey, Dr B. F. Shumard, Dr. A. Litton, and F. B. Meek. Their report was the first complete geological report published under direction of the Government. Capt. Howard Strasburg in June, 1849, started on his expedition by way of Platte River and Ft. Bridger to Salt Lake, which they reached the last of August. He remained here in winter quarters until April, 1850, and then made various surveys in Utah and returned to Leavenworth in November.

From 1850 to 1860 the U. S. Government made numerous surveys to the Pacific which were chiefly entitled "Explorations of a Railroad Route from the Mississippi River to the Pacific Ocean."

Since 1860 the surveys have been chiefly conducted by the U. S. Geological and Geographical Surveys under authority of Interior Department, also the Engineer Department of the United States Army, and their publications have been many.

NATURAL SCIENCE IN THE 17TH CENTURY.

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It is a curious fact that the bulk of history is composed of the lives and deeds of men who were great monarchs, valiant generals, base tyrants, or bloody murderers. One grows tired of reading of war and carnage, sin and sorrow, widows and orphans, and all the long catalogue of evils wrought and recorded in the Past. Surely there is another side to this gloomy picture. Surely there are pursuits which men may follow, and which men have followed and therefrom reaped pleasant harvests. Yea, "in the conquests of science no widow's or orphan's tears are shed, no captives are dragged from their homes, and no devoted victims are yoked to the chariot wheels of the triumphant philosopher."

While reading the history of Louis XIV of France, I was struck with the

glory of the court, the pulpit, the literature, etc., of the country over which he reigned, and I began to inquire whether the 17th century, in the midst of its splendid achievements, had not accomplished something in the fields of Nature. I turned to look and my search was not in vain. A list of those then engaged in quiet researches for knowledge of Nature and her phenomena constitutes a roll of illustrious names. True, not as many of them belong to France as to neighboring countries; perhaps for the reason that France could not furnish the steady plodding workers that science requires. Frenchmen are better suited to make the "beau monde"; they have ever been a fickle people which every breath of fortune could move.

But at the beginning of the 17th century, what was the status of natural science? What growth had then been made by that tree of knowledge which to-day flourishes in such splendid proportions and yields such varied fruits to mankind everywhere?

Before the 17th century we find very little of true science—that is, of knowledge systematized by the correlation of facts obtained from thorough experimental research. There is sufficient reason for this state of affairs.

The art of printing was inveuted in the 15th century, but did not come into extensive use until the 16th century. Until that time all books had been *written*, and hence were scarce and costly. On this account intercommunication of workers in science were slow and the promulgation of a new truth, discovery or invention took much time. The invention of printing served to overcome this great difficulty. Yet there was a still greater hindrance to the growth and spread of knowledge. It was that sentiment, so prevalent among mankind at that day, that "The horizon bounds the limits of the world." The common herds of humanity supposed the limits of human ken had been reached, and their pastors —the priesthood—permitted them to cherish the notion; because thereby they could the more easily impose upon the credulity of their followers, and lead them into whatsoever pastures they pleased.

Perhaps deep down in the seclusion of some old cloister, a far-reaching mind probed to the core of some hitherto unopened apple of nature and found a wonderful secret hidden therein; the fact was selfishly used for personal aggrandizement by imposing upon a too credulous people, or kept and not disclosed, through a servile fear of the spirit of the times.

Nor was the search of these recluses always in pursuit of real gems of truth, but rather of phantoms born of heated imaginations. Thev sought the means whereby all baser metals could be transmuted into gold and the "elixir vitæ" which would rejuvenate old age and perpetuate the bloom of youth. In the course of these mad and laborious efforts they stumbled upon many things which in after times became useful in the arts and sciences.

Nevertheless the world is now enjoying the high-risen sun of a day that dawned with the 17th century. Day must succeed night, and the long night of the dark ages passed away with the dawning that broke over the world when Louis XIV was King of France. Then it was that men began to emancipate

themselves from the old rusty shackles of slavery to the past and its long established order of things, and to strike out for themselves into new ranges and regions of nature and of thought. Independence of thought begets independence of spirit. They who so long had passively worn the harness of servitude and obedience to monarchy and men in power, became recalcitrant and demanded rights and privileges, even going so far in some cases as to compel them to be given. Freedom of thought marks the birth of enlightenment and the beginning of mightier and grander things. Men of inquiring minds, tired of the toil and tumult of war, and quite famished for went of encouragement at the hands of mankind in general, began to meet together and discuss their thoughts where sympathy and interest were sure to attend. From such beginnings arose the idea of scientific societies; and we find before the close of the 17th century the Royal Society of England (1645), the French Academy of Sciences (1666), the Imperial Academy of the Curious in Nature (Germany, 1662), and others in Italy and adjoining countries.

These scientific societies were the centres into which flowed all the streams of scientific thought. At their convocations capable minds discussed the old or the new theories of men, and after due deliberation the bad ones were either rejected or corrected, and the good ones were sent forth into the world with a sanction that rendered them a thousand-fold more acceptable.

A still more important result arising from these scientific bodies must be confessed in the following fact. The disciples of science, who in one country were restrained from making known their work by publication at home, on account of the stringency of prevailing laws, could send abroad and be sure of sympathy and aid Thus was given to the world for the promotion of human welfare, many a a newly discovered invention or discovery which otherwise might have cowered at home for years and years, held "in durance vile" by ignoble servitude to opinions whose only authority was the weight of hoary years.

Hence we are safe in saying that the temple of natural science had its foundation laid at this time in permanent form, and at this period steady growth of the superstructure began. Workmen came from England, from France, from Italy, from Germany, in fact, from all civilized lands, and lent their enthusiastic aid.

Scaffolds of theory were built around, upon which standing, the workmen laid up the permanent blocks of law and established fact. When the scaffolds became untenable, weak, inadequate, they were removed and others more adequate erected in their stead. Workmen served their allotted time and yielded their places which were forthwith filled by others. And to-day in the broad glare of the 19th century the toilers in science are as vigorously as ever altering the scaffolds and on the already lofty walls laying up other beautiful and substantial stones. The temple will be finished—when? Ah! who can tell?

But let us return to the 17th century and call the roll of master-workmen, and note some of the stones which were placed in the lower walls of the temple of science.

TABLE—COMPILED FROM BUCKLEY'S HISTORY OF NATURAL SCIENCES, AND OTHER SOURCES.

	NAME.	NATIVITY.	LIFE.	WORK.
CHEMISTRY.	Van Helmont,	Belgium,	1577—1644.	Gas, from geist—Spirit. Gas sylvestre=Car-
	Becher,	Germany,	1625—1682.	Theory—2 elements. Boracic acid.[bonic acid
	Hooke,	England.	1635—1702.	Air necessary to life and combustion (1665).
	Mayow,	England,	1645—1679.	Fire air=Oxygen, and a lighter gas in air.
	Stahl,	Germany,	1660—1734.	Phlogiston.
GEOLOGY.	Steno,	Denmark,		Petrifactions (1669).
	Scilla,	Italy,		Fossils of Calabria (1670).
	Woodward,	England,		Collection of Rocks and Fossils (1695).
BOT. AND ZOOL.	Malpighi,	France,	1628—1694.	Spiracles of insects (1669). Germination of
	Grew,	England,	1628—1711.	Vegetable anat. Stomates (1676). [Seeds.
	Ray,	England,	1628—1705.	Classification of Animals and Plants and
	Willoughby,	England,	1635—1672.	publication (1682 ——).
	Tournefort,	France,	1656 ——.	Systemati: Classification (1694—1700).
PHYSIOLOGY.	Harvey,	England,	1578—1657.	Circulation of the Blood (1628).
	Asellius,	Italy,	1581—1626.	Lacteals (1622).
	Pecquet,	France,	—— ——.	Thoracic duct (1647).
	Rudbeck,	Sweden,	1630—1702.	Lymphatics (1651).
	Malpighi,	France,	1628—1694.	Capillary circulation (1661).
	Leuwenhoeck,	Holland,	1632—1723.	Animalcular Life.
	Ruysch,	Holland,	1638——.	Injections in Microscopic Work.
ASTRONOMY.	Galileo,	Italy,	1564—1642.	Moons of Jupiter (1610), Sun-Spots (1611),
	Kepler,	Germany,	1571—1630.	Laws of Planetary Movement. [etc.
	Gassendi,	France,	1592—1655.	Transit of Mercury (1631).
	Horrocks,	England,	1619—1641.	Transit of Venus (1639).
	Newton,	England,	1642—1727.	Gravitation (1682), tides, etc.
	Halley,	England,	1656—1742.	Sun's distance by Transits. *Comet.*
NATURAL PHILOSOPHY.	Jansen, Lippersheim,	Holland,	—— ——.	Refracting Telescope (1609).
	——	——	—— ——.	Microscope (1660?).
	——	——	—— ——.	Mercurial Thermometer (1670). [Science.
	F. Bacon,	England,	1561—1626.	Novum Organon (1620). Experimental
	Galileo,	Italy,	1564—1642.	Pendulum (1580?). Telescope (1610).
	Drebbel,	Holland,	1572—1634.	Alcohol Thermometer.
	Snellins,	Holland,	1591—1626.	Refraction of Light-Law (1621).
	Descartes,	France,	1596—1650.	Prism and Dispersion of Light.
	Torricelli,	Italy,	1608—1547.	Barometer (1644).
	O. Guericke,	Prussia,	1602—1686.	Air Pump (1650). Elec. Machine (1672).
	Boyle,	Ireland,	1626—1691.	Compressibility of Gases (1661).
	Mariotte,	France,	——1684.	Compressibility of Gases. Blind Spot in Eye.
	Huyghens,	Holland,	1629—1695.	Pendulums in Clocks (1650). Wave Theory
	Gregory,	Scotland,	1638—1675.	Reflecting Telescope (1663). [of Light (1678).
	Newton,	England,	1642—1727.	Light, dispersion, etc., etc.
	Roemer,	Denmark,	1644—1710.	Velocity of Light by Moons of Jupiter (1676).
	Papin,	France,	1650—1710.	Steam-Pump (1690). Safety Valve ——.
	Newcomen,	England,	—— ——.	Steam-Engine (1705).

We find the list of the illustrious names so small that it may be said, there ought to have been more, and for the reason that the great treasuries of nature were all untouched. This is true; but the way to them was unknown. And for this reason we can but admire the perseverance of the few men who plodded through the mazes of the untraversed wilderness and won such wonderful prizes as they did. Just here it may not be out of place to add that the above fact of the recent birth of science is worth a great deal in an argument with the skeptic who denies the inspiration of the Scriptures. Whence came the wonderful knowledge of creation, given in such beautiful order as verified by modern investigation, related in the first chapter of Genesis? Either scientific knowledge such as is now extant was possessed by its author, or else he was divinely inspired. We are prone to believe the latter.

Especially is it to be noted that the wonderful advances and discoveries of age (and future ages as well,) came very largely as the result of the invention of the telescope and microscope. By these instruments admission was gained for the first time to the macrocosm and the microcosm between which man with his native powers had hitherto existed.

Not much was done in geology and chemistry; these sciences had their true birth in the 18th century.

CHEMISTRY.

THE ELEMENTS.

J. H. GLADSTONE, PH.D., F. R. S.

(*An address delivered before the Chemical Section of the British Association.*)

Though theoretical and practical chemistry are now intertwined, with manifest advantage to each, they appear to have been far apart in their origin. Practical chemistry arose from the arts of life, the knowledge empirically and laboriously acquired by the miner and metallurgist, the potter and the glass-worker, the cook and the perfumer. Theoretical chemistry derived its origin from cosmogony. In the childhood of the human race the question was eagerly put, "By what process were all things made?" and some of the answers given started the doctrine of Elements. The earliest documentary evidence of the idea is probably contained in the Shoo King, the most esteemed of the Chinese classics for its antiquity. It is an historical work, and comprises a document of still more venerable age, called "The Great Plan, with its Nine Divisions," which purports to have been given by Heaven to the Great Yu, to teach him his royal duty and "the proper virtues of the various relations." Of course there are wide differences of opinion as to its date, but we can scarcely be wrong in considering it as older than Solomon's

writings. The First Division of the Great Plan relates to the Five Elements. "The first is named Water; the second, Fire; the third, Wood; the fourth, Metal; the fifth, Earth. The nature of water is to soak and descend; of fire, to blaze and ascend; of wood, to be crooked and to be straight; of metal, to obey and to change; while the virtue of the earth is seen in seed-sowing and in gathering. That which soaks and descends becomes salt; that which blazes and ascends becomes bitter; that which is crooked and straight becomes sour; that which obeys and changes becomes acrid; and from seed-sowing and ingathering comes sweetness."[1]

A similar idea of five elements was also common among the Indian races, and is stated by Prof. Rodwell to have been in existence before the fifteenth century B. C., but though the number is the same, the elements themselves are not identical with those of the ancient Chinese classic; thus, in the Institutes of Menu, the "subtle ether" is spoken of as being the first created, from which, by transmutation, springs air, whence, by the operation of a change, rises light or fire; from this comes water, and from water is deposited earth. These five are curiously correlated with the five senses, and it is very evident that they are not looked upon as five independent material existences, but as derived from one another. This philosophy was accepted alike by Hindoos and Buddhists. It was largely extended over Asia, and found its way into Europe. It is best known to us in the writings of the Greeks. Among these people, however, the elements were reduced to four—fire, air, earth, and water—though Aristotle endeavored to restore the "blue ether" to its position as the most subtle and divine of them all. It is true that the fifth element, or "quinta essentia," was frequently spoken of by the early chemists, though the idea attracting to it was somewhat changed, and the four elements continued to retain their place in popular apprehension and still retain it even among many of the scholars who take degrees at our universities. The claim of wood to be considered an element seems never to have been recognized in the West, unless, indeed, we are to seek this origin for the choice of the word "*ulé*" to signify that original chaotic material out of which according to Plato and his school, all things were created.[2] The idea also of a primal element, from which the others, and everything else, were originated, was common in Greece, the difficulty being to decide which of the four had the greatest claim to this honor. Thales, as is well known, in the sixth century B. C. affirmed that water was the first principle of things; but Anaxamenes afterwards looked upon air, Heraclytus upon fire, and Theracleides on earth, as the primal element. This notion of elements, however, was essentially distinct

1 Quoted from the translation by the Rev. Dr. Legge. In that most obscure classic, the *Yi-King*, fire and water, wind and thunder, the ocean and the mountains, appear to be recognized as the elements.

2 Students of the Apocrypha will remember the expression in the "Book of Wisdom," xi., 17, * * * * * * * ("Thy Almighty hand, that made the world of matter without form"). The same book contains two allusions to the ordinary elements, vii., 17, and xix., 18 to 20. The word elements is used in the New Testament only in a general sense (2 Peter, iii., 10), or in its more popular meaning of the first steps in knowledge.

from our own. It was always associated with the idea of the genesis of matter rather than with its ultimate analysis, and the idea of *simple* as contrasted with *compound* bodies probably never entered into the thoughts of the contending philosophers.

The modern idea appears to have had a totally different origin, and we must again travel back to China. There, also in the sixth century B. C., the great philosopher Lao-tse was meditating on the mysteries of the world and the soul, and his disciples founded the religion of Taou. They were materialists; nevertheless they believed in a "finer essence," or spirit, that rises from matter, and may become a star; thus they held that the souls of the five elements, water, metal, fire, wood, and earth, arose and became the five planets. These speculations naturally led to a search after the sublimated essences of things, and the means by which this immortality might be secured. It seems that at the time of Tsin-she-hwang, the builder of the Great Wall, about two centuries before Christ, many romantic stories were current of immortal men inhabiting islands in the Pacific Ocean. It was supposed that in these magical islands was found the "herb of immortality" growing, and that it gave them exemption from the lot of common mortals. The emperor determined to go in search of these islands, but some untoward event always prevented him.[3]

Some two or three centuries after this a Taouist, named Weipahyang, wrote a remarkable book called "The Uniting Bond." It contains a great deal about the changes of the heavenly bodies, and the mutual relation of heaven and men; and then the author proceeds to explain some transformations of silver and water. About elixir he tells us, "What is white when first obtained becomes red after manipulation on being formed into the elixir tan," (meaning red or elixir). "That substance, an inch in diameter, consists of the black and the white, that is, water and metal combined. It is older than heaven and earth. It is most honorable and excellent. Around it, like a wall, are the sides of the cauldron. It is closed up and sealed on every side, and carefully watched. The thoughts must be undisturbed, and the temper calm, and the hour of its perfection anxiously waited for. The false chemist passes through various operations in vain. He who is enlightened expels his evil passions, is delighted morning and night, forgets fame and wealth, comprehends the true objects of life, and gains supernatural powers. He cannot then be scorched by fire, nor drowned in water, etc., etc. * * * The cauldron is round like the full moon, and the stove beneath is shaped like the half moon. The lead ore is symbolised by the White Tiger; and it, like metal amongst the elements, belongs to the West. Mercury resembles the Sun, and forms itself into sparkling globes; it is symbolised by the Blue Dragon belonging to the East, and it is assigned to the element wood. Gold is imperishable. Fire does not injure its lustre. Like the Sun and Moon it is unaffected by time. Therefore the elixir is called 'the Golden Elixir.' Life can be lengthened

3. Nearly all the above statements relating to this Taouist alchemy are derived from the writings of the Rev. Joseph Edkins, of Pekin, and the matter is treated in greater detail in an article on the "Birth of Alchemy," in the *Argonaut*, Vol. iii., p. 1.

by eating the herb called Hu ma; how much more by taking the elixir, which is the essence of gold, the most imperishable of all things! The influence of the elixir, when partaken of, will extend to the four limbs; the countenance will become joyful; white hair will be turned black; new teeth will grow in the place of old ones, and age at once become youth. * * * Lead ore and mercury are the bases of the process by which the elixir is prepared; they are the hinge upon which the principles of light and darkness revolve."

This description suggests the idea that the elixir of the Taouists was the red sulphide of mercury—vermilion—for the preparation of which the Chinese are still famous. That Weipahyang believed in his own philosophy is testified by a writer named Ko-hung, who, about a century afterwards, wrote the lives of celebrated Taouists. He tells how the philosopher, after preparing the elixir, took it, with his disciples, into a wood, and gave it first to his dog, then took it himself, and was followed by one of his pupils. They all three died, but, it appears, rose to life again, and to immortality. This brilliant example did not remain without imitators; indeed, two emperors of the Tang family are said to have died from partaking of the elixir. This circumstance diminished its popularity, and alchemy ceased to be practiced in the Celestial Empire.

At the beginning of the seventh century the doctrine of Lao-tse was in great favor at the Chinese court; learning was encouraged, and there was much enterprise. At the same time the disciples of Mohammed carried their arms and his doctrines over a large portion of Asia, and even to the Flowery Land. Throughout the eighth century there were frequent embassies between eastern and western Asia, wars with the Caliphs, and even a matrimonial alliance. We need not wonder, therefore, that the teachings of the Taouist alchemists penetrated westward to the Arabian philosophers. It was at this period that Yeber-Abou-Moussah-Djafer-al-Sofé, commonly called Geber, a Sabæan of great knowledge, started what to the West was a new philosophy about the Transmutation of metals, the Philosopher's Stone, and the Elixir of Life; and this teaching was couched in highly poetic language, mixed with astrology and accompanied by religious directions and rites. He held that all metals were composed of mercury, sulphur, and arsenic, in various proportions, and that the noblest metal could be procured only by a very lengthy purification. It was in the salts of gold and silver that he looked for the Universal Medicine. Geber himself was an experimental philosopher, and the belief in transmutation, led to the acquirement of a considerable amount of chemical knowledge amongst the alchemists of Arabia and Europe. This gradually brought about a conviction that the three reputed elementary bodies, mercury, sulphur, and salt or acid, were not really the originators of all things. There was a transition period, during which the notion was itself suffering transmutation. The idea became gradually clearer that all material bodies were made up of certain constituents, which could not be decomposed any further, and which, therefore, should be considered as elementary. The introduction of quantitative methods compelled the overflow of mediæval chemistry, and led to the placing of the conception of simple and compound bodies upon the

foundation of scientific facts. Lavoisier, perhaps, deserves the greatest credit in this matter, while the labors of the other great chemists of the eighteenth and the beginning of the nineteenth centuries were in a great measure directed to the analysis of every conceivable material, whether solid, liquid, or gaseous. These have resulted in the table of so-called elements, now nearly seventy in number, to which fresh additions are constantly being made.

Of this ever-growing list of elements not one has been resolved into simpler bodies for three-quarters of a century; and we, who are removed by two or three generations from the great builders of our science, are tempted to look upon these bodies as though they were really simple forms of matter, not only unresolved, but unresolvable. The notation we employ favors this view and stamps it upon our minds. * * * * —*Chemical News.*

ARTIFICIAL STONE AS A BUILDING MATERIAL.

The high antiquity of prehistoric remains is frequently authenticated by the presence of the "sun-baked bricks" found among them. The *Encyclopædia Britannica*, in an article on St. Jean d'Acre (a town and seaport in Syria, and in ancient times a place of some celebrity), says: "Its great antiquity is proved by fragments of houses that have been found, consisting of that highly sunburnt brick with a mixture of cement and sand, which was only used in erections of the remotest ages."

In Scotland, Ireland, and Wales it has been found that the most durable material of those old "castles of the gallant clans" is concrete, in which small cobble stones were embedded to form a solid piece of masonry.

The Moors have left samples of their artificial stone inwrought upon the rock of Gibraltar, which have withstood successfully the storms of ten centuries. The Colosseum at Rome presents further examples which have nobly resisted the tests of time; the cisterns of Solomon, near the city of Tyre, which are of still higher antiquity, are almost complete in their preservation; and at Jerusalem there are to be seen five immense courses of Cyclopean masonry, the base of the wall of the city (now inclosing the Mosque of Omar), supposed to be a remnant of the wall of the Temple of Solomon, which, as the record tells us, was "set in its place *without the noise of the hammer and the ax.*"

Scientists have suggested that the Pyramids were mainly built of artificial blocks, manufactured upon the spot, from the sands of the surrounding plain, by some cunning process which has perished with the builders; and travelers have claimed that the Diocletian or "Pompey's" Pillar, and the ruins of Baalbec and Palmyra, are mainly of artificial stone. Whatever may be said of these, we have in the actual measurements of the enigmatical "coffer" in the king's chamber of the Great Pyramid indubitable evidence of its original plasticity. In the first place, we find it depressed upon all its sides, from the corners toward the center, and *unequally* so. The east side of the coffer has been sadly mutilated by tourists, the

southern corner being chipped away about two-fifths its height. The mean depressions are at the north end 0.26 inch, at south end 0.19 inch, at west side 0.20 inch, and at east side 0.01 inch. They are observable vertically as well as horizontally. At the south end of the west side there is no depression perceptible; while at the north end of the same side the depression is 0.20 inch, and on the south end, at different distances from east to west, the depressions are 0.08, 0.12 and 0.14 inch. Upon all sides the coffer is highly polished over all these inequalities. Now, no one acquainted with the simplest means of working natural stone would look for these inequalities, and for the corresponding *bulging out upon the inner surfaces* which we find to exist.

The square, the plummet, and the rule would have done their perfect work before the polishing, and if the depressions had been *intentional*, they would have been *regular*. Again, if we take the superficial outside measurements of the coffer, we find the same irregularity. On the east side near the bottom we have a length of 90.5; ten inches below the top, 90.15; on the top, 90.20. On the west side near the bottom, 89.2; near the top, 89.95; at the top, 90.05; mean length, 90.01. At the north end near the bottom, 39.05; near the top, 38.7; at the top, 38.67. At south end near bottom, 38.8; near top, 38.6; at top, 38.5; mean width, 38.72. From all which we argue that the coffer was moulded in its present position from plastic material, but that it became thus slightly warped, or shrunken, as it dried —in short, that it is of artificial stone, and not of "porphyry," of "black marble," or of "a darkish variety of red and possibly syenitic granite," as has been variously asserted.

Coming down to a later period and a little nearer home, we have in the city of Santo Domingo some of the most interesting historical monuments of this material. This is the oldest existing settlement by white men in the New World, being founded by Bartolommeo Columbus in 1494. Although built on a solid limestone formation, the city is surrounded by a wall of artificial stone, eight feet thick, built (in 1506) of *mamposteria*, "a composition of earth, powdered stone, and lime." Many of the more ancient houses and public buildings of the city, constructed of this material, are still standing and are remarkable for their solidity; the cathedral, especially, in which the remains of Columbus and his brother Bartolommeo reposed for two and a half centuries, which was begun in 1512 and finished in 1540; while on the opposite bank of the river the so-called "Castle of of Columbus," a fortified stone house subsequently built by Diego Columbus, the son of the great admiral, is in ruins.

The Vanne Aqueduct, in France, is another example. Gen. Gillmore characterizes this as "the most important and costly work that has yet been undertaken in this material," being thirty-seven miles in length. This aqueduct, which supplies the city of Paris with water, traversing the forest of Fontainbleau its entire length, comprises two and a half to three miles of arches (some of them as much as fifty feet in height), eleven miles of tunnels, and eight or ten bridges (from seventy-five to one hundred and twenty-five feet span) for the bridging of rivers, canals, and highways. The smaller arches are half circles, and are gener-

ally of a uniform span of thirty-nine feet four inches, with a thickness at the crown of fifteen and three-fourths inches. Their construction was carried on without interruption through the winter of 1868–69 and the following summer, and the character of the work was not affected by either extreme of temperature. The spandrels were carried up in open work to the level of the crown, and upon the arcade thus prepared the aqueduct pipe was moulded of the same material, the whole becoming firmly knit together into a perfect monolith. The construction of the arches was carried on about two weeks in advance of work on the pipe, and the centres struck about a week later.

The lighthouse at Port Said, in Egypt, is another interesting structure of this material. It is one hundred and eighty feet high, without joints, and rests upon a monolithic block of the same material containing nearly four hundred cubic yards.

An entire Gothic Church, with its foundation, walls and steeple in a single piece, has been built of this material at Vesinet, near Paris. The steeple is one hundred and thirty feet high, and shows no cracks or other evidences of weakness. M. Pallu, the founder, says that "during the two years consumed by M. Coignet in the building of this church, the material in all its stages was exposed to rain and frost, and it has perfectly resisted all variations of temperatures."

But we have upon our own shores a building antedating these structures nearly thirty years. This is the residence of the late George A. Ward, Esq., at New Brighton, Staten Island, familiarly known as "the cement house," built in 1837, and ten times more solid to-day than the day it was erected. There is no more exposed place to test the stability of this material than the north shore of Staten Island, where this building stands. We confess to some misgivings as we approached it last summer, not having seen it for about thirty years, but we left it more than satisfied, and to such of our readers as require the test of Thomas the doubter, we commend a pleasant trip over the Bay of New York, and a personal inspection.

Another building is the residence of Wm. E. Ward, Esq., at Portchester, N. Y. This is beyond doubt the most expensive private residence of the kind yet erected in this country. It is a perfect monolith, from the lowest line of the cellar wall to the top course of its towers, and is a monument at once of the enterprise, taste, and munificence of its proprietor, a monument, too, which is likely to endure when some other monuments have crumbled in decay. A full description of this building was given in the *American Architect* of August 17, 1877, and a further description was read before the American Society of Mechanical Engineers, at their recent meeting in the city of Cleveland. Perhaps the severest tests to which the material has ever been subjected were in the great Chicago fire of 1871. While granite was chipped and splintered into fragments, while limestone was reduced to powder, while sandstone was disintegrated, and iron twisted into fantastic shapes, artificial stone alone remained intact, and was in shape to be immediately relaid. Several instances could be given, conspicuous among which, however, is the front of the store 114 Monroe Street, which, although thrown

down by the failure of its iron supports, was taken up, stone by stone, and relaid. Many of the stones were placed in their original positions; some few were fractured by the fall, and had to be replaced by fresh ones, but none were disintegrated or fractured by the fire, and all were utilized. The front stands to-day exactly as it did before the fire.

The architect is often required to manage a sea wall or a cellar wall where the action of water is to be considered in connection with the safety of his superstructure. And here we claim the vast superiority of this material. In basements it will be found not only waterproof, but *rat proof*. The United States Government has recently employed it as the base of a lighthouse in the Chesapeake, where heavy masonry had proved inadequate, and they would have done better if they had followed the example of the French Government in the construction of the lighthouse at Port Said, and constructed the whole building of the same material. As a sea wall, the jetties of the Mississippi are perhaps the best example we have in this country. When we consider that this great river is the outlet of twenty of our States and Territories, covering an area of 750,000,000 acres —the granary and the principal cotton producing region of the world—the importance of these jetties cannot be overestimated. And hand in hand with their far-reaching commercial value is the triumph they have so signally achieved for artificial stone; for it must be conceded that without this element of success, the jetties would have been a failure. Indeed, they had already proved so, and in less energetic hands they might have been abandoned. The jetties themselves, primarily jets or projections of wicker work, anchored in place and secured in position by rubble and heavy stone, proved inadequate to resist the easterly storms that sometimes prevail, and it became evident that some further protection of the work was required. Heavier stones, some of them weighing three thousand pounds, were accordingly and with great difficulty anchored upon the jetties; but these proved also insufficient. Resort was now had to monolithic masses of artificial stone, and they have proved successful where nothing else could; some of the blocks being thirteen feet in width, five feet thick, and fifty-five feet long, and weighing more than two hundred and sixty tons. One mile of the east jetty and half a mile of the west were thus effectually protected, and so complete were the appliances employed upon the work that it required only the hands of two men to mould them and place them in position.

The jetties at the mouth of the Suez Canal are of a cheaper quality of beton, and are not monolithic, the blocks weighing only about twenty tons; but they are sufficient for the purpose, eighteen thousand of them being employed in the work.

From the description we have given, the far-reaching utility of this material is quite palpable. Its durability is established beyond cavil, and it has the approval of the most eminent architects and engineers of both hemispheres. While other material is constantly undergoing disintegration and decay, this as constantly improves by age. In the air, in the water, in the fire, and in fact under all im-

aginable circumstances, the certainty of using it with success is one of the greatest of its recommendations.—H. in *American Architect.*

MEDICINE AND HYGIENE.

CLIMATE IN THE CURE OF CONSUMPTION.

SAMUEL AUG. FISK, M. D.

HUMIDITY.—There is a unanimity of opinion amongst authorities in regard to the relation of moisture to the production of phthisis. The seventh annual report of the registrar-general of Scotland showed that the death-rate from phthisis diminished in proportion to the dryness of the location. Dr. H. I. Bowditch, of Boston, has shown that phthisis is prevalent in damp soils in the United States. "It is also common in Holland, and other countries liable to damp fogs and an atmosphere saturated with moisture" (Reynold's System of Medicine, III. 548). Ruehle, in Ziemssen, says, "It appears that moist air favors consumption." Dr. Austin Flint says, "It may be stated that the prevalence of the disease is less in climates either uniformly warm and dry or uniformly cold and dry." And Dr. C. T. Williams writes, "As to the desirability of moist climates for consumptive patients, the evidence is decidedly against their use in the treatment of ordinary chronic phthisis."

If we attempt to explain why it is that phthisis is more prevalent in moist climates than in dry, we might assign as a cause the prevalence of germs, or the impurity of the air, containing the effluvia of decay, or perhaps the greater susceptibility of the system to cold in moist climates; or it may be that the air, being so near saturation, cannot take up the requisite amount of the aqueous vapor exhaled from the lungs. *Causa latet vis est nota* may adequately express the state of our knowledge in regard to this point. A moist climate is acknowledged to be a breeder of phthisis; and, *au contraire*, a dry climate is known to afford a certain exemption from the disease. This shown by the fact that the disease is rare in Iceland, in the island of Morstrand, on the steppes of Kirghis, and in the interior of Egypt; in all of which places the element of elevation is wanting. It may, then, be conceded, that dryness of the air is an important element in the prophylaxis and cure of phthisis.

The method of determining the humidity of the air is that introduced by Regnault, known as the wet- and dry-bulb test. It can easily be seen that the results obtained will depend on the exposure of the thermometers, and on the accuracy of the readings. Moreover, the amount of moisture that the air is capable of holding varies with the atmospheric pressure and temperature.

While it seems to us that a table showing the relative humidity, *i. e.*, the

percentage of saturation of the air, would be sufficiently accurate as a basis of comparison, yet, as it might be objected that such a table would be subject to error, we have appended another table, giving the absolute moisture, or the number of grains of vapor to the cubic foot of air. This second table we have computed from Glaisher's Tables.[1]

Consulting these tables it is seen that Denver and Santa Fe afford a very low relative and absolute amount of atmospheric moisture,—a relative amount, which, as between Denver and Jacksonville, is as 1 to 3, and, as between Denver and Los Angeles, is as 1 to 2.

This proves, that, on the eastern slopes of the Rocky Mountains, we have, in addition to the favorable element of elevation, a second, that of dry air, as an element of climatic influence in the cure of phthisis.

PRECIPITATION.—Closely related to the foregoing, is a consideration of the mean annual precipitation, or the mean annual amount (in inches) of rain and melted snow. Its bearing on our subject is apparent in several ways.

1. Of the precipitation, a certain part is lost by evaporation, and tends to increase the humidity of the air. This amount will depend upon the amount of moisture in the air, or its degree of saturation, and also upon the amount of the precipitation left upon the surface of the ground to be evaporated. It is evident that the greater the porosity of the soil, the greater will be its absorptive power, and the less the evaporation from it. Such a porous soil is found on the eastern slopes of the Rocky Mountains. Loose, sandy, and gravelly, it eagerly drinks up all the rainfall; and such a thing as mud is rarely seen.

2. It is well known that pulmonary troubles are most prevalent during "thaws," in those places where the snow lies upon the ground in winter. Now, in the district of the Rocky Mountains under consideration, there is, in the first place, only a slight amount of snowfall, so that sleighing is exceptional, and, in addition, the warm sun soon melts the snow, and the thirsty, porous soil drinks it up; so that the annual "spring thaw" of our Eastern States is a *res incognita* in this country. The writer remembers very distinctly several snowfalls of fourteen to twenty-two inches on a level, of which there was not a vestige left in ten days; and during that time the air was not chill and raw, and there was but little slush.

3. Further than this, the amount of the precipitation has a bearing upon our subject, as indicating approximately the ability of the invalid to lead an out-of-door life. We shall defer our discussion of this point to a later part of this paper.

Turning now to the tables we see that in Denver the mean annual precipitation for a period of ten years is only 14.77 inches in rain and melted snow,—an amount which is only one-fourth of that at Jacksonville, and which, with Santa Fe, gives the smallest showing in our range.

We can, therefore, add this element of climate to the other two of elevation and dry air as a point in favor of the Rocky Mountains in the cure of phthisis.

1 Omitted.

TEMPERATURE.—The writer in Reynold's System (*op. cit.*) says of this matter of the relation of the temperature of climate to the cure of phthisis, "It was formerly supposed that warm climates were beneficial for consumptive patients. * * * But it will be invariably observed that unaccustomed warmth is injurious. * * * What is really required, is a cool, temperate climate, free from great alterations of temperature." Dr. Austin Flint (*op. cit.*) calls attention to the fact, that "the disease is oftener developed during the spring months and hot months of summer," when either there is a great deal of moisture in the air, or the debilitating effects of heat are present as factors. On the other hand, Ruehle says that the temperature has "nothing to do with the prevalence of consumption."

It is known that the effect of heat is to raise the body temperature, to lessen the number of respirations, to quicken the pulse, to lessen the digestive powers and the appetite, to diminish the excretion of urea because of the diminishing of the ingesta, and to depress the nervous system, especially if the heat be accompanied with excessive moisture. It seems, then, that it can be stated as a fair inference from the foregoing, that a dry, temperate climate is to be sought by the phthisical invalid. The Rocky Mountains furnish a dry climate. The table shows that the mean temperature is only a mean between the extremes in our range. The question will, however, be presented in a better form farther on.

WINDS.—The points of importance in regard to the winds are their velocity and direction. It is well known that they are regulated somewhat by changes in atmospheric pressure and temperature.

Velocity.—It is known that a cold wind abstracts body-heat, and in proportion to its velocity. By consulting our tables it will be seen that the mean daily velocity of the winds at Denver is less than it is in the Eastern States; and that as a consequence, while the mean temperature is nearly the same, the chilling effect will be much less. On the other hand, as it has a considerably greater velocity, and as there are fewer calms than at either Augusta or Los Angeles, it has a proportionately greater purifying power in bringing fresh ozone, and in blowing away the products of decomposition.

Direction.—Of more importance than the velocity, is the direction of the winds. The favorable and unfavorable directions vary for different places, according to their geographical location. The east and north winds are known to be the trying ones along the Atlantic coast; and our table shows that the northeast wind is the prevailing one at both Augusta and Jacksonville. The west wind, blowing from the Pacific Ocean, and bringing fogs, is the trying one on the California shore; and the table shows that this is the prevailing one at Los Angeles. The south wind is the salubrious one for the eastern slope of the Rocky Mountains, in Colorado; and our table shows that this is the wind that blows there most frequently.

We can therefore add this element to the others,—of elevation, dryness of air, small amount of precipitation, and mean temperature,—as favorable to the Rocky Mountains as a place for phthisical patients to resort.

CLEAR, FAIR, AND CLOUDY DAYS.—We now come to the consideration of our last general point, that is, to an investigation of the number of clear, fair, and cloudy days; or, in other words, to a consideration of the amount of sunshine.

As to the direct effect upon health produced by light and sunshine, we are still in ignorance. Whether the blood is made to course more rapidly, and the nerves transmit impulses more readily, under the influence of the solar ray is not known. It is well known that the actinic rays have a powerful chemical effect upon vegetation; but whether or not they have a like influence upon the human economy is unknown.

Without attempting to refine, there are certain broad and positive effects in the cure of phthisis attributable to sunshine. The experience of the profession is fittingly expressed by the words of Dr. Austin Flint: "I would rank exercise and out-of-door life far above any known remedies for the cure of the disease."

In the table which we present, and which is a mean of daily observations for a period of five years, a cloudy day is one in which the heavens are from seven-tenths to entirely obscured by clouds; a fair day is one in which the heavens are from four to seven-tenths clouded; all else are classed as clear days. From this it will be seen, that for our purposes clear and fair days may be classed as one, and may be put into juxtaposition with the cloudy days. Consulting these tables, it will be seen, that in Denver the mean number of cloudy days in a year is only one-half of what it is in either Augusta or Jacksonville, that it is less than a half of what it is in St. Paul, and that it is slightly less than what it is in Los Angeles.

To put this fact in another way, it is seen, that in Denver there is only about one-eighth of the entire year when an invalid would be kept in the house on account of the weather; in Jacksonville and Augusta he would be confined to the house, for the same reason, one quarter of the year; in St. Paul he would be kept in-doors between a third and a quarter of the time; while in Boston he would have to be housed a good third of the time.

Admitting, then, the force of Dr. Flint's statement, our tables show that there is no place in this whole country, where it is possible for the invalid to enjoy so much fresh air and sunshine, as in the Rocky Mountains. For three hundred and twenty days out of every three hundred and sixty-five it is possible to roam at large, and to breathe in health.

We feel, that, so far, our tables have shown that the Rocky Mountains furnish climatic conditions of elevation, humidity, precipitation, temperature, winds, and sunshine, which recommend them as a resort for phthisical invalids superior to anything to be found in this country.

OBSERVATIONS BY SEASONS.—Having arrived at these general conclusions, the writer wishes to call attention very briefly to their accuracy and importance as applied to the different seasons of the year. He wishes to lay stress upon the evidence which goes to show that Colorado and New Mexico furnish favorable resorts for phthisical invalids during the winter and spring,—the very seasons that are most trying in the east, the seasons that they are obliged to avoid, and

to seek new abodes at the resorts. The elements of elevation and barometric pressure will remain nearly constant the year round. But how is it in regard to the *humidity* of the air in Colorado during the winter and spring? The writer has selected at random, and without reference to whether the showings would be favorable or unfavorable for a given place, the year 1880 as his basis for comparison. Both the relative and absolute humidity for Denver during the winter and spring is absolutely, and by comparison, very small; that, as compared with Augusta and Jacksonville, it makes a wonderful showing in these respects; and that the ratio of the absolute humidity as between Denver and Los Angeles is as 1 to 3 for these seasons.

When we turn to our tables we learn that the amount of *precipitation* at Denver for these seasons was almost *nil;* that the mean monthly precipitation at Denver for the given time was only a small fraction of an inch in rain and melted snow. Carry out, now, the comparison between Denver and Augusta, Jacksonville and Los Angeles, and see the tremendous difference in this particular between these places,—showing immensely in favor of Denver. It will be seen that our general conclusions are very much strengthened by this particular application, and that we have brought strong additional evidence in favor of Colorado as a resort for persons affected with phthisis pulmonalis.

When we turn to our tables to learn in regard to the *winds* at these places for the given seasons, we see that the conclusions previously reached in regard to Denver, in this particular, still hold true.

Temperature.—We come now to our last observation, and to a brief discussion of what some may consider the weak point in regard to Colorado as a resort for invalids. It has been seen that most authorities favor a cold climate; but they add the proviso that it should be free from change. The mean monthly range of temperature is larger for Denver than for almost any other point in our scale. It will be seen, further, that the minima of temperature are very nearly the lowest in the scale,—not so low, to be sure, as the minima at St. Paul, but decidedly lower than at Augusta, Jacksonville, and Los Angeles. This state of affairs demands an explanation.

We have seen that the air of Colorado is both dry and rare,—two conditions that favor rapid radiation. We have seen, further, that the soil is of a porous, sandy nature,—a kind that will easily absorb heat, and as easily give it off. Furthermore, there is but little verdure or shade,—another condition, too, which will favor both absorption and radiation of heat. In consequence of these conditions, the soil and air are, on the one hand, rapidly heated in the morning, and they are equally rapidly cooled at night. The nights are always cool in Colorado,—a condition that renders the summer months enjoyable and invigorating. But the question, after all, is, whether this diurnal change of temperature is injurious to Colorado as a resort for invalids. We claim that it is not, and for this reason: it makes but little difference to the invalid how cold the nights are, for at that time he should be in-doors, where he can regulate the temperature; but it is of importance that it should be warm at mid-day, so that he can take his exercise regularly

and comfortably. We have seen, that so far as conditions of sunshine, humidity, and rain- and snow-fall are concerned, the invalid can lead an out-of-door life a greater percentage of the time in Colorado than anywhere else in this country; and we claim that he will never find these factors counterbalanced by the element of temperature. An experience of several years warrants the writer in asserting that an invalid can, with perfect comfort and safety, spend several hours in the saddle nearly every day of the three hundred and sixty-five. One has but to read 'H. H.'s' writings to learn how attractive out-of-door life is in Colorado, even in mid-winter; and we can positively assert that we have known of picnics being held day after day, in the open air, in the very heart of the winter, and that there are days and weeks in mid-winter when one can sit with doors and windows open.

In conclusion, the writer would state, that while his personal experience in regard to a desirable climate for the cure of phthisis has been such as to convince him of the great superiority of the climate of the Rocky Mountains over any other in this country, yet in this article he has tried to put aside any personal bias, and he desires to carry conviction only in so far as he has been able to adduce facts, and to interpret them rationally and logically. He would state, further, that, if the reader should take exception to any interpretation given to the facts, the tables still stand as the best and most reliable data of these facts attainable, and they are not to be controverted. —*Science.*

CORRESPONDENCE.

LETTER FROM WEST CHESTER, PA.

WEST CHESTER, PA., October, 1883.

EDITOR REVIEW:—Of the numerous scientific papers received, none is more welcome than your Kansas City REVIEW, from the far west. Coming from a section from which we have not been looking for enlightened information, we are surprised to find it so rich in interesting original matter, and so well sustained by local talent.

Perhaps I appreciate it the more highly because of its treating of subjects in which I have long been deeply interested.

For a few years past I have been engaged in collecting relics of the stone age in this section of Pennsylvania (the southeastern corner), and now presume that I have one of the best collections in it. Thinking that a few remarks upon these remains of the aborigines might interest you I take the liberty of sending you the results of some of my observations.

In the first place we have no mounds here, or known evidence of the mound-

builders ever having reached so far east. A very few copper implements have been found, but they had evidently been transported from the Lake Superior region, and are only masses of native copper that have been beaten into desired shapes.

Our country is well watered. Springs of good water are to be found in every section. Near these springs, on any piece of level upland that would be rapidly drained after a rain, are to be found the camping grounds of the ancient inhabitants. They are easily traced when plowed up, by the chips and spalls of white quartz left in making their arrow-heads, this being the most common material used here. We also find larger camping grounds on some slight elevations near what in early ages have been good fishing places on our streams.

In the Susquehanna River near where it crosses the line between Pennsylvania and Maryland is an island containing about sixty acres. The river is here broad and shallow. In early times the fish in the spring of the year must here have been innumerable, and have been easily captured, affording food for vast numbers The island seems to have been common grounds where numerous tribes could meet in peace. Food being plenty, there would be less incitement to war.

The want of food I believe has ever been the principal cause of wars between savage tribes. An overgrown tribe would use up its supply of game and then be forced to trespass upon the preserves of their neighbors, when this would, of course, bring on a contest which would end in the decimation of one or both tribes. The game would again have a chance to recuperate, and for a time peace would reign.

The island spoken of, when I first saw it, was literally covered with relics, and, I might safely say, that cart-loads of arrow-heads, stone axes, pestles, and mortars, have been carried away from this place, showing that it must have been the resort of vast numbers at a time, or had been a noted place through many ages. I have been unable to trace out any burial place on or near the island. A few miles below this place are to be found many sculptured or figured rocks in the bed of the river. The rocks are of serpentine, and the figures are roughly made. These are the only attempts at this kind of work that I know of in this section.

All burial places that I have seen opened here, have contained more or less of modern European relics, such as beads and iron tomahawks.

Yours, etc, A. SHARPLESS.

LETTER FROM PLEASANT HILL, MO.

PLEASANT HILL, MO., October 8, 1883.

The REVIEW for October promptly came to hand. It is an interesting number. Several very excellent articles. I was particularly interested in that relating to the manner the ancient Egyptians quarried and worked rock. Strange Rawlinson, in his otherwise interesting book, says nothing of this. If they had

not the diamond drill they possessed a drill of the same principle. The stone used in the sets of their drills and saws must have been corundum. The emery of Turkey in Asia is celebrated the world over. Its hardness and composition is about the same as corundum and they belong to the sapphire group,—No. 9, scale of hardness; diamond being 10.

Yours truly, G. C. BROADHEAD.

ASTRONOMY.

SUN AND PLANETS FOR NOVEMBER, 1883.

W. DAWSON, SPICELAND, IND.

On the 1st of November the Sun's R. A. is 14 h. 26m.; and his declination 14° 29′ S. On 30th his R. A. is 16h. 26m, and declination S. 21° 41′. The days are thus approaching their shortest; and the winter constellations are coming into view from the east. Sun-spots have been unexpectedly numerous thus far (18th) during October: fifty to nearly one hundred spots having been counted several times and one hundred and thirty-five were visible through my 4.6 inch telescope on the 9th, and one hundred and fifty on the 15th. One spot was visible to the naked eye on the latter date. Mercury will be too near the Sun for observation during November. It will be in superior conjunction with the Sun about midnight of the 25th. Venus is evening star; but will scarcely repay an effort for observation till toward the close of the month; and not very good then, being so far south. Mars is wending its way eastward from Jupiter, toward opposition. It is getting nearer the earth and better for observation, though it is yet a morning star. It will rise about 10 P. M. the last of November.

Jupiter is stationary near the Bee-Hive cluster on the 21st, and is very near there all the month—changing place among the stars but very little. On the 1st it passes the meridian at 5:40 A. M., 20° south of Zenith; and at 3:40 A. M., on the 30th, at about the same declination. On the 1st of November Jupiter rises a little before 11 P. M., and on the last of the month about 9 P. M.

Saturn will be an object of interest all the month; rising on the 1st at 6:30 P. M. and two hours earlier on the 30. It will be at its nearest point to Aldebaran, 3½° north, at midnight, November 1st, and will be in opposition to the Sun on the 28th. The oval ring of Saturn may be nicely seen with a spy-glass two and a quarter inches in diameter, magnifiying fifty times. Uranus is about 1° east of Beta in Virgo. Neptune occupies a blank region in Taurus, about 8° SW. of the Seven Stars.

New Moon occurs about six hours before the beginning of November; and also about 1 P. M., November 29th. The Moon passes near Saturn at noon on the 15th and Jupiter four days and two hours later.

KEPLER'S THIRD LAW.

EDGAR L. LARKIN.

This law is one of the corner-stones of modern astronomy; and its discovery a turning-point in the history of the science. Its first presentation to students is usually attended with more or less difficulty, and with the hope of aiding such we endeavor to give a simple exposition of the great law. It is given in different words by astronomers; and here are several versions:

I. "The square of the time of revolution of each planet is proportional to the cube of its mean distance from the sun." Newcomb and Holden's Astronomy, p. 125.

II. "The squares of the periodic times of any two planets are to each other in the same proportion as the cubes of their mean distances from the sun." Herschel's Outlines of Astronomy, p. 259.

III. "The squares of the times are as the cubes of the mean distances from the sun." Ray's Elementary Astronomy.

IV. "The squares of times of revolutions are to each other as the cubes of the distances from the sun." Robinson's University Astronomy.

V. "The squares of the times of revolution of the planets around the sun are proportional to the cubes of the major axis of their orbits." Guillemin's The Heavens.

VI. "The squares of the periodical times are as the cubes of the major axes of the orbits." Olmstead's Astronomy, p. 99.

It seems that matters might be simplified by using the word equal, thus:—

VII. The squares of the times are equal to the cubes of distances.

It follows then that if we square the periodic time of any planet, we know that the square is equal to the cube of its distance from the Sun, and to find the distance we extract its cube root.

Table I gives the periodic times of all the planets, and their squares. Column 1 gives the times of revolutions around the sun, and II the squares of these numbers:

TABLE I.

Names of Planets.	Periodic Times.	Periodic Times Squared.
Mercury	.24084	.058039
Venus	.61519	.378458
The Earth	1.	1.
Mars	1.880819	3.53748
Jupiter	11.8617	140.7
Saturn	29.456626	867.516
Uranus	84.01447	7058.4311
Neptune	164.615	27098.

But the squares of the times are equal to cubes of distances; whence the cube roots of the numbers in the second column, (Table I,) are equal to all planetary distances from the Sun. In Table II we give the squares of the times in the first column, and their cube roots in the second; which roots are the distances of all the planets from the solar globe.

TABLE II.

Names of Planets.	Squares of their Periodic Times.	Cube Roots of Squares of Times, or Mean Distances.
Mercury	.058039	.3872
Venus	.378458	.7233322
The Earth	1.	1.
Mars.	3.53748	1.5238
Jupiter	140.7	5.2016
Saturn	867.516	9.5371
Uranus	7058.4311	19 182
Neptune	27098.	30.036

The relations of the numbers in both tables can be easily seen; thus: Neptune revolves around the Sun in 164.615 years, whose square is 27098, the cube root of which is 30.036; hence we know that this distant world is 30.036 times farther from the Sun than is the earth.

The truth of the law is demonstrated by elongations of Mercury and Venus, without knowing their, or the earth's distance from the Sun. Kepler did not know the distance from the earth to the Sun; but he knew ratios. He was aware that the distance from the Sun to Mercury is .3872; to Venus .723 and .1 to the earth; and from these facts detected the third law. This law of nature is one of the most important elements of knowledge, and is capable of wide generalization. Not only do planets and satellites obey it,—bodies moving on orbits of small eccentricity,—but likewise comets, which traverse paths of the greatest possible elongation. All bodies whatever, that revolve around one another in cosmic space, must obey this inexorable rule. If suns wheel about their common centres of gravity, then the squares of their periods of revolution must be equal to the cubes of their distances apart; but the units of measures for times and spaces are peculiar to each system of revolving bodies, only determined by their masses. When we observe a fact in nature, we know that it depends on another immediately preceding it; law stands on law; every law has an antecedent and exists as a consequent. Now what great law of nature is next preceding the third of Kepler? What makes it follow of necessity? What is the cause of the fact that squares of times equal cubes of spaces? We are almost on metaphysical ground, since we are dealing with such abstractions as time, space, and motion. The reason why the law of Kepler exists is because every particle of matter attracts every other with an intensity which is directly proportional to the quantity of matter they contain, and inversely proportional to the square of the distance between them.

In this law we come upon square of distance, but in Kepler's we found square of time ; let us see if there is any relation.

It is proven in the higher analysis, that spheres attract matter that is upon their surfaces with a force that can be found by dividing the mass of the sphere by the square of the radius. It follows from this, that the intensity of attraction of a sphere at at any distance from it can be determined by dividing gravity on its surface by the square of the desired distance. This is simply another way of stating the law of gravity as given above. Now, the force of gravity exerted upon the earth by the mass of the Sun is equal to 1, how great is it at Mercury? The distance of Mercury from the Sun is .3872 whose square is .15022384; whence 1 divided by .15022384 eqnals 6.66; therefore solar gravity exerted on Mercury is 6.66 times stronger than on the earth. In this method, we divided gravity at the earth's distance by the square of Mercury's distance, that is: we made use of square of *space;* but singularly enough, the same result can be reached by using square of *time.* Thus, if we divide Mercury's distance from the Sun, by the square of its periodic time, we will have .3872 divided by .058039=6.66 as before.

The law of gravity might be given in this manner: the attraction of the Sun on each planet is equal to its distance divided by the cube of its distance. Thus: —the distance of Jupiter from the Sun is 5.2016 whose cube is 140.7; and 5.2016 divided by 140.7=.037229, which is the intensity of gravity exerted on Jupiter by the Sun, that on the earth being 1. But we have arrived at the same point whence we started at the beginning of this note, because, since 140.7 is the cube of the distance of Jupiter, it is also by the law,—the square of the time of its revolution. Here is a table of intensities of solar attraction exerted on all the planets, found by dividing their mean distances by the squares of periodic *times*, instead of the usual way of dividing gravity on the Sun's surface by squares of planetary distances. We made use of time in place of space. The first column gives the mean distances of planets; the second, the squares of their periodic times, and the third,—quotients of the first divided by the second, which are the intensities of solar attraction, light and heat, on all the planets, and also the centrifugal tendencies developed by planetary motions.

TABLE III.

Names of Planets.	Distances of Planets.		Squares of their Periodic Times.	Solar Gravity Heat and Light, and Centrifugal Tendencies.
Mercury . . .	.3872	÷	.058039	=6.66
Venus	.7233322	÷	.378458	=1.9135
The Earth . .	1.	÷	1.	=1.
Mars	1.5238	÷	3.53748	= .4306
Jupiter	5.2016	÷	140.7	= .037229
Saturn	9.5371	÷	867.516	= .0109737
Uranus . . .	19.182	÷	7058.4311	= .0027177
Neptune . . .	30.036	÷	27098.	= .001108

In the mechanism of the solar system, therefore, we find mutual relation of forces depending on squares of time, space and velocity, a portion of which being given the others may be found. And Kepler's law is a beautiful generalization of them all. Indeed, the movements of the great machine are more majestic than it is possible for the mind of man to fully realize.

NEW WINDSOR, ILL., October 13, 1883.

ASTRONOMICAL NOTES FOR NOVEMBER, 1883.

W. W. ALEXANDER, KANSAS CITY, MO.

THE SUN'S apparent R. A. on the 1st will be 14h. 26m.; the Earth's annual motion will increase his R. A. by the 30th to 16h. 25m. His south declination on the 1st will be 14° 29′; this will be 21° 41′ by the last of the month.

VENUS—will be Evening Star, and by the end of the month may be seen low down in the southwest for about thirty minutes after sunset. Its apparent diameter is slowly increasing. The apparent R. A. will increase from 15h. 9m. to 17h. 42m.

JUPITER—will be in R. A. on the 1st 8h. 25m., this will only increase two minutes during the entire month; its declination will be 19° 35′ on the 1st, and the same on the last of the month; the apparent diameter is rapidly increasing caused by its reaching the stationary point on the 20th. At this time the Earth's annual motion will be bearing us in a direct line towards this planet; He will then be near Præsepe, the beautiful group, or cluster of stars in Cancer; it will rise about 8:30 P. M. at a point 19° north of east.

SATURN—will be in the best possible position for telescopic observation; being in opposition or 180° from the Sun on the 28th; the beautiful rings of this planet are opened full to the view, and will present a magnificent sight. It will be in the constellation Taurus, and on the 1st will be in conjunction with Alpha Tauri, better known as Aldebaran; the star will be 3° 30′ south of the planet.

URANUS—will not be in a favorable position for observers this month, being too near the Sun.

NEPTUNE—will be in the best possible position, being in opposition with the Sun on the 12th; it will then rise just at sunset at a point 15° north of east; the apparent R. A. on the 1st will be 3h. 12m., on the 30th 3h. 8m. No person need spend time trying to see this planet without a good telescope and proper appliances for pointing to its place in the heavens; all the light we receive from this brother world is only equal to an eighth magnitude star.

GEOLOGY.

THE U. S. GEOLOGICAL SURVEY, 1883.

Secretary Teller has just received the annual report of Major J. W. Powell, Director of the geological survey for the fiscal year ended June 30, 1883. The report states that the principal work accomplished by the bureau during the year was in the preparation of the large geological map of the United States authorized by a recent act of Congress. It is estimated that a scale of four miles to the inch will be necessary for this map, which it is proposed to publish in atlas sheets, each comprising one degree of longitude by one of latitude, in areas bounded by parallels and meridians. In the progress of this work the bureau has necessarily availed itself of the results of all surveys accurate enough to fulfill the requirements of the map, and during the past fiscal year has been engaged in collecting, compiling, and adjusting the materials. Field operations have been carried on to a limited extent. An area of 8,700 square miles was surveyed in the southern Atlantic region, and good progress was made in the Rocky Mountain district by surveys in the plateau region of Utah, Arizona, and New Mexico. In the Pacific district the work outlined includes the survey of the Cascade Mountains in Oregon, northern California, and probably in Washington Territory.

Director Powell says that this region is believed to contain the grandest and most extensive display of natural phenomena now known in any part of the world, and the investigation of it promises to supply matter of great importance to geologic science. In California about 2,000 square miles of country have been surveyed, a work of great difficulty. A large part of the report is devoted to subsidiary reports of special investigations, which may be briefly summarized as follows: The study of glacial phenomena, which are described as among the most important and interesting subjects for investigation in the geology of this county, was intrusted to Mr. Chamberlain, and he has been engaged in collecting and grouping evidences of the former existence of a continental placier similar to that which is believed to cover the greater part of Greenland. His purpose was to ascertain its former extent and distribution of its lines of movement, and the part it has played in shaped the physical features of the country.

Prof. Irving has been laboring with great energy in the study of the metamorphic rocks in the Lake Superior region, and has made satisfactory progress.

Mr. G. K. Gilbert has investigated the traces of the former existence of a large fresh water lake in western Nevada; its relations to changes in climate, its former extent, and its general history. His study has brought to light many interesting and instructive facts.

The geologic work in the Cascade range was not begun during the last fiscal

year, and Capt. Dutton, to whom it had been intrusted, occupied himself with an investigation of the volcanoes of the Hawaiian Islands.

Researches in the mining districts of Colorado have been made by Mr. S. F. Emmons, and promise to throw much light on the theory of veins and their relations to the eruptive rocks with which they are associated. In the Gunnison district valuable beds of both anthracite and bituminous coal, of a quality unsurpassed in Colorado, have been found, and promise to make that locality one of the most important in the State. The ore bodies of the district also appear to be much of importance. The results of the investigations of minerals collected in Colorado have proved to be of great value to geology, so much so as to have elicited commendations from investigators, both in this country and in Europe.

A reconnaissance of the California quick-silver districts has been begun by Mr. Becker, and the work will be energetically prosecuted.

The search for extinct vertebrate remains has been continued under the direction of Prof. Marsh, and its results have proved to be of the greatest interest.

Special examination of the so-called Laramie beds which prevail over a large portion of the west, and constitute the most important part of the western coal bearing horizons, have been made by Dr. C. A. White. Other specialists have been engaged in the collection of fossils.

In the physical laboratory at New Haven much time has been spent in the adjustment of instruments of precision, chief stress being laid upon investigations relating to the exact measurement of high temperatures.

Very interesting results have also been attained by experiments to ascertain the physical properties of steel—experiments which throw much light upon the exact nature of the differences between that metal and other forms of iron.—*National Republican.*

ASBESTOS AND ITS APPLICATIONS.

Asbestos, a peculiar variety of the amphibole or hornblende family of minerals, is most largely found in Canada and Italy. It occurs in regular layers or veins, generally as a grayish-green rock made up of innumerable fine crystaline fibres which become soft, white, and of a silky lustre when separated from each other by slight pressure. The thickness of the veins varies considerably in different localities, from a thin sheet, in the case of the variety known as mountain-leather, to several inches in the deposits of the delicate amianthus found in the older crystalline rocks, in the Pyrenees, the Alps of Dauphiny, the St. Gothard, the Savoy, and Corsica. A single fibre of asbestos, heated in the flame of a blow-pipe, readily fuses to a white enamel, the varieties containing most iron being most easily fused, but in the mass it resists the heat of an ordinary flame, and for this reason it has recently begun to attract considerable attention. Unfortunately, the fibres of asbestos differ from all other known fibres in having a perfectly

smooth surface and in being much less elastic than those of either animal or vegetable origin, in consequence of which all efforts to spin and weave them by modern machinery have until very recently entirely failed. In addition to amianthus and mountain-leather, there are several other varieties of asbestos, for instance, mountain-cork, which is a brownish or dirty-white deposit, less flexible and less regular than amianthus and mountain-leather, and so light as to float on water; mountain-wood, a soft, opaque, brownish colored variety, which melts to a black slag before the blow-pipe; and lastly, the common asbestos, which has recently been descovered in large quantities in Canada, in veins from one inch to two inches thick, and which is the kind most generally used for manufacturing the various articles to which we shall have occasion to refer.

The introduction of asbestos for such purposes as engine-packing and jointing for pipes has been attended with very considerable difficulty. Of all materials, it is perhaps that which requires the most careful manufacture and intelligence in adapting it to its special purposes; and when these have not been sufficiently exercised, users have been disappointed, and have not unfrequently given up the trial in disgust. As already stated, the peculiarity incidental to asbestos fiber for a long time baffled all attempts to spin it into yarn without the intermixture of a certain proportion of flax or other vegetable fiber. Within the last few years, however, the difficulty has been overcome, and yarns capable of withstanding great tensile stresses can now be readily produced by machinery specially constructed for the purpose. One of the most important applications of this yarn is for the manufacture of steam-packings. In making packing, it was at first not sufficiently recognized that the fibers of asbestos were apt to be largely charged with minute particles of pyrites; and until this fact was appreciated, it was often found that the piston-rods were scored, the damage being attributed to the action of the asbestos itself, instead of to the impurities it contained. To obviate this defect, it therefore became necessary to thoroughly cleanse the asbestos from all stone and grit before spinning, for which duty machinery had to be adapted. The yarn now produced is quite pure, and is capable of being woven into almost any kind of fabric. But it was soon ascertained that special cases required special treatment, and though the plaited packing was generally satisfactory, it became evident that something else was wanted in the case of steam-engines with extremely high piston speeds. To meet this demand, the yarn was first woven into a cloth, which, being slightly water-proofed with vulcanized India-rubber, was rolled up into a rope in much the same way as the canvas is treated in what is known as Tuck's packing, only without the rubber core. This packing answered admirably, and is much used in cases where the rapid destruction of ordinary packings gave rise to most serious inconvenience. The enduring powers of this asbestos block-packing are quite remarkable. In one place, on being taken out after twelve months' working with steam of seventy pounds pressure, it was found to be perfectly good, and was accordingly replaced. It has often been erroneously stated that asbestos packing could be used without lubrication. No greater mistake could exist. It not only requires a good supply of oil, but

demands careful attention on the part of the engineer in charge. If carefully manufactured and properly used, asbestos is the best material for packing the glands of steam-engines; but if ignorantly made up and carelessly used, it is probably the worst.

A great deal of yarn is woven into cloth, and is adapted for a great variety of purposes. One noteworthy application is for fire-proof curtains, and several of these have been supplied by Mr. Bell for theatres in Great Britain, the United States, and elsewhere. So important is this material considered in regard to the prevention of the spread of conflagrations that a company has been formed in New York with the sole object of extending its use in the shape of protective shields, either permanently fixed or applied in case of a sudden emergency. In relation to this application, a fire-shield was recently exhibited at a meeting of the Firemen's Convention held at Rochester, N. Y., and attracted very great attention. The shield consisted of a piece of pure asbestos cloth about twenty feet square, and supported on an iron frame. A pile of pine wood saturated with petroleum and tar was built on the windward side of the curtain, and set on fire. The blaze was tremendous, and the heat so intense that persons could not stand within fifty feet of the burning mass on the exposed side. On the side protected by the shield, however, the heat was scarcely felt, and a dummy erection of wood and glass, which was placed close beside it, was not in any way injured. The curtain, of course, did not suffer, and was as good after the experiment as it was before.

For forming the joints of pipes exposed to the action of moisture, and for man and mud-hole doors requiring frequent removal, asbestos woven cloth is very largely in demand. In these cases, asbestos millboard, which is the cheapest form of jointing material, is comparatively worthless, if, indeed, it is not absolutely objectionable, from its permeability to water, which soaks through and attacks the iron of the bolts, and it was therefore necessary to devise a combination which would effectually resist the heat and damp. This is provided in what is known as asbestos and India rubber woven sheeting, which is made in any thickness, and is supplied either in sheets to cut to the required shape, or in a tape from one to two inches wide, which can be cut to lengths and bent to circle or oval without puckering. When all other materials have failed to give satisfaction, this has answered admirably, and in the case of man-hole and mud-hole doors and feed-water pipes, the joint can be broken twenty times without requiring renewal of the strip.

The last application of the yarn which we shall mention is the manufacture of rope and cord. Having great tensile strength, and being unaffected by heat and damp, this material is in course of introduction for sash-lines and for ropes of fire-escapes. It is also adopted for covering rollers in print-works, especially when aniline dyes are used, and in cases when it is exposed to great heat and to the action of hydrochloric acid. Asbestos cord has also been found to be the most effectual material for making the joints of the hot-air pipes for blast-furnaces, which are exposed to an exceedingly high temperature. The jointing consists of

an iron ring wrapped with the cord, which is simply put in place and nipped between two flanges, and, being unaffected by heat, lasts a very long time.

We now come to an entirely different manufacture of asbestos, in which the rock, after being broken down and reduced to fluff, is pulped and formed by pressure into sheets from one-sixty-fourth to one-half inch in thickness. This mill-board, as it is called, is used for making joints not exposed to the action of moisture, such as for dry steam, air, and gas. When properly made and used with faced surfaces, this material affords the easiest and most cleanly method of making a joint, while, if the faces are previously painted over with boiled oil, the danger of having a troublesome leaky joint is reduced to a minimum. The board is easily cut to the desired size, and as no time is required for drying and setting, steam can be turned on as soon as the bolts are screwed up. A much commoner and cheaper description, though it still possesses most of the essential qualities, is manufactured for fire-proofing floors and ceilings. It is made in sheets about one-thirty-second of an inch thick, and is applied in the simplest possible way, either above or below the joists. It is also used for lining the walls of wooden buildings, where, from its non-conducting and fire-proof qualities, it affords an immense protection in case of the outbreak of fire. As an insulator of electricity, asbestos in one form or another is greatly sought after. Millboard has for some time been used in the construction of dynamos, while cables and leads covered with plaited yarn have been adopted in many installations. The remaining uses of asbestos which we have to notice appear to be mainly in the production of fire-proof cement and putty, for which there is considerable demand for certain kinds of joints, and in the manufacture of fire- and acid-proof lumps, blocks, and bricks. The ordinary gas fire is familiar to everyone, and it will suffice to point out that asbestos enters largely into the composition of the artificial fuel upon which the success of the fire in a great measure depends.—*Engineering and Mining Journal.*

GUNNISON, THE BONANZA COUNTY OF COLORADO.

JOHN K. HALLOWELL.

Mr. Hallowell closes his account of this county in the following enthusiastic terms:

The foregoing represents as succinctly as possible a resumé of what is the general characteristics in mineral wealth of this country, so that I have found in brief, that within a radius of seventy-five miles of Gunnison City, there are 2,000 square miles of mineral lands, with more ore per square mile than was ever seen before in the world to know it. That the drainage of all but three points is towards a common center meeting at Gunnison; that the whole country is readily accessible, having two competing railroads, narrow gauge, with a prospect of a third and broad gauge road within three years; that branch lines have been or

will be extended to both coal sections; that Gunnison County has expended this year (1882) $100,000 in making good wagon roads from railroad points to all of the most developed mining camps. That, although this county is barely three years old, work enough has been done to prove that these mineral sections are permanent and productive. That Gunnison City is located in the centre of the largest mineral belt now known; with coal fuel the nearest by of the very best quality, and in quantity sufficient to smelt the ores produced. That this season saw one of the most successful concentrating mills in the State, built in this part of the country, viz: at Elko on Rock Creek. That, personally, I have not visited a single mining camp but that is capable, in time, of furnishing forty to 1,000 tons per twenty-four hours, of concentrating ore for just such mills, and which are the practical mills for all mining districts.

That, at Gunnison City there is now a smelting furnace building by one of the most successful men, connected with ore reduction (lead ores) in the United States. That, I have seen, personally, enough gold and silver districts, in this described territory, to produce more of those values per annum, after the next five years' development, than was the output of the whole State of Colorado in the year 1882. That, I have seen lead ore enough, and indications of it sufficient to warrant the statement, that the product will in time compare favorably with the output of the State of Missouri.

That I have examined more iron ores than are now known in either of the States of Pennsylvania or Missouri.

That I have seen districts enough, with copper sulphides in their veins, to run a smelter plant on the Copper-Matte basis, ten times as large as the present works at Argo, Colo. (Hill's works).

That within this territory I have found Tellurium ores. That I have been over more than eight square miles of territory containing nickel and cobalt—more than was ever seen before in paying quantities. That there are 350 square miles of gold territory, almost wholly unimproved, in which it may be possible to find Iridium, Palladium and Platinum. That I have found traces of tin, but have not proved its existence in paying quantities. That there is building stone of unsurpassed quality and inexhaustible quantity; that limestones, gypsum and marbles exist in large quantities. That I have found that rare mineral Uranium to exist in paying quantities. That while I did not find fire-clay at all, I found immense quantities of ordinary clay for building brick.

Last, but not least, the climate is unsurpassed, elevation not too great, nor winters too severe, but that work in the mines can be carried on the whole year through with a proper preparation; that the valleys are mild, well watered, and the finest stock country in Colorado.

METEOROLOGY.

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

The usual summary by decades is given below.

TEMPERATURE OF THE AIR.	Sept. 20th to 30th.	Oct. 1st to 10th.	Oct. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min				
Max				
Min. and Max				
Range				
TRI-DAILY OBSERVATIONS.				
7 a. m.	52.3	52.00	43 4	49.2
2 p. m.	71.7	78.70	59.0	69.5
9 p. m.	56.7	65.20	47.6	59.8
Mean	60.6	65.30	49.1	59.5
RELATIVE HUMIDITY.				
7 a. m.	.88	.94	.88	.90
2 p. m.	.60	.66	.60	.63
9 p. m.	.80	.68	.89	.79
Mean	.75	.76	.79	.77
PRESSURE AS OBSERVED.				
7 a. m.	28.98	28.98	29.14	29.06
2 p. m.	28.97	29.14	29.12	29.07
9 p. m.	28.98	29.01	29.22	29.07
Mean	28.98	29 03	29.14	29.07
MILES PER HOUR OF WIND.				
7 a. m.				
2 p. m.				
9 p. m.				
Total miles	2736	2958	2701	8395
CLOUDING BY TENTHS.				
7 a. m.	4 4	6.6	6.4	5.8
2 p. m.	3.8	6.4	7.2	5.8
9 p. m.	1.9	6.7	4.5	4 4
RAIN.				
Inches	.33	2.15	2.29	4.77

The first frost of the season at this station occurred October 14th. This was quite a severe white frost, and it killed the sweet potato vines in most situations. There had been, of course abundant time for all crops to mature, and the rainfall has again been considerably above the average.

The lowest temperature was 29° on the morning of the 14th, and the highest September 29th, 91°. Highest pressure on the 15th 29.450 in., reduced 30.429 in. Lowest pressure on the 1st 28.520 in., reduced 29.452 in.

BOOK NOTICES.

THE MOUNDS OF THE MISSISSIPPI VALLEY, HISTORICALLY CONSIDERED. By Lucien Carr. Quarto, pp. 106.

This essay is reprinted from the second volume of the "Memoirs of the Kentucky Geological Survey," and is divided into three chapters, with an introduction, viz: The Indian as an Agriculturist; The Indian as a Worshiper of the Sun, and The Indian as a Mound-Builder. The object of the paper is to show that, "admitting all that can be reasonably claimed by the most enthusiastic advocate of the superior civilization of the Mound-Builders, there is no reason why the red Indians of the Mississippi Valley, judging from what we know, historically, of their development, could not have thrown up these works."

Taking up the usual argument that the Indians were hunters and hence migratory in their habits, not remaining long enough in one locality to erect such immense works as are found in some portions of the United States, the author devotes a chapter to showing successfully by an extended array of proofs, derived from numerous reliable sources, that they were an agricultural people, cultivating vast crops of corn and other edibles, and that contrary to the usual idea, they were a settled people and had an abundance of time to devote to such structures.

To the argument that the Mound-Builders were sun-worshipers, and hence of a different race from the red Indian of modern times, he opposes a chapter of indubitable proofs that even to a very recent period all the tribes of Indians were given to the same form of worship.

In his final chapter Mr. Carr shows that all North American tribes have been mound-builders and that it was comparatively easy, even with the primitive tools and baskets used in excavating and transporting the earth used in their construction, for these Indians to have erected any of the mounds yet discovered in the Mississippi Valley. As he says in conclusion, "Summing up the results that have been attained, it may be safely said that so far from there being an *a priori* reason why the red Indians could not have erected these works, the evidence shows conclusively that in New York and the Gulf States they did build mounds and embankments that are essentially of the same character as those found in Ohio," "and that one of the more elaborate of them, viz: the mound at Circleville, in which were found articles of iron and silver, was built after contact with the whites, and therefore by recent Indians." He further claims "in view of these results and of the additional fact that these same Indians are the only people, except the whites, so far as we know, who have ever held the region over which these works are scattered," that the mounds and inclosure of Ohio, like those in New York

and the Gulf States, were the work of the red Indians of historic times or of their immediate ancestors.

It is a valuable work, full of suggestive points fortified by proofs collected from a multiplicity of sources.

EIGHTH ANNUAL REPORT OF THE RAILROAD COMMISSIONERS OF MISSOURI. 8vo., pp. 193. State Journal Co., Jefferson City, Mo., 1883.

This is the report for 1882, made by the Commissioners, Messrs. A. M. Sevier, Geo. C. Pratt, and James Harding, who seem to have covered the ground very thoroughly.

When Missouri created this Board only eleven of the States had them; now there are twenty-two such boards, showing that their services have been found beneficial. The number of miles of railroad constructed in the State during 1882 was 260.97, giving a total of 4501.58 in operation at the close of that year. Out of 115 counties in Missouri only seventeen were without railroad facilities within their borders, and we presume that by this time even that number has been reduced by the construction of the Kansas City & Memphis Road through the southeastern portion of the State. There are over eighty main lines and branch roads in the State, operated by twenty-six companies. The net earnings of these roads for 1882 were $2,198 per mile of road, or thirty-five per cent of the gross earnings.

This report is very full and statistical, and closes with a compilation of the laws of the State governing railroads.

ANNUAL REPORT OF THE REGENTS OF THE SMITHSONIAN INSTITUTION FOR 1881: Octavo, pp. 839. Government Printing Office, 1883.

This volume, as usual, consists of the Proceedings of the Board of Regents, the Annual Report of the Secretary, Prof. S. F. Baird, the Report of the Executive Committee and the General Appendix, comprising a record of recent progress in the principal departments of science, and special memoirs, original and selected, of interest to collaborators and correspondents of the Institution, teachers, and others engaged in the promotion of knowledge.

The Astronomical Report is made by Prof. E. S. Holden, Director of the Washburn Observatory, Madison, Wisconsin; that upon Meteorology, by Cleveland Abbe; Physics and Chemistry, by Prof. George F. Barker, of the University of Pennsylvania; Botany, by Prof. Wm. G. Farlow; Zöology, by Theodore Gill; Anthropology, by Prof. Otis T. Mason, of Columbian College; History of Smithsonian Institution Exchanges, by Geo. H. Boehmer.

The feature of including these reports is an admirable one and gives great additional value to the volume. If it could be made possible to publish the Report near the close of the same year, instead of two years afterward, it would be an improvement that would be most highly appreciated. The Smithsonian Report is always looked for with eager anticipation and received with warm wel-

come; more so than almost any other: hence its publication, especially in view of this new feature, should be expedited as much as possible.

QUESTIONS OF BELIEF: Edited by Titus Munson Coan. 12mo., pp. 204. G. P. Putnam's Sons, New York, 1883. For sale by M. H. Dickinson; paper 25c, cloth 60c.

This is Number V of Volume I of the "Topics of the Times" series, and contains the following timely and able articles: The Responsibilities of Unbelief, by Vernon Lee, from the *Contemporary Review*, May, 1883. Agnostic Morality, by Francis Power Cobbe, from the *Contemporary Review*, June, 1883. Natural Religion, by Edmund Gurney, from *Mind*, April, 1883. The Suppression of Poisonous Opinions, by Leslie Stephens, *Nineteenth Century*, March and April, 1883. Modern Miracles, by E. S. Shuckburgh, from the *Nineteenth Century*, January, 1883.

Number VI of this popular series will be entitled "Art and Literature," and will be ably represented.

CONSTITUTIONAL AMENDMENT MANUAL: By J. Ellen Foster. 12mo., pp. 100. New York. National Temperance and Publication House.

The authoress of this work is a lawyer of prominence in the State of Iowa, who has given much of her time to the temperance cause, and this little volume is prepared as a contribution on her part in aid of "the temperance workers in the various States who desire to join the movement for Constitutional Prohibition with enforcing statutes in both State and Nation."

It contains arguments, appeals, petitions, forms of constitution, catechism, and general directions for organized work for constitutional prohibition. Many of our western readers will remember Mrs. Foster's earnestness, eloquence, and ability in the lecture field when here a few months since.

THE LIFE OF WASHINGTON: By Washington Irving. Two volumes; Quarto, pp. 226. G. P. Putnam's Sons, New York; paper 60c. For sale by M. H. Dickinson.

This is known as the Centennial Edition and is complete in two parts with many illustrations. Of the work itself it is unnecessary to speak, as every reader knows that the life of Washington includes, necessarily, the history of the American Revolution, and that no writer has ever presented the same amount of carefully compiled history in the same elegant, perspicuous and attractive style. The cheapness of this edition, the agreeable size of the print and the beauty of the illustrations will cause it to be sought for on all hands.

WAR SONGS, for Anniversaries and Gatherings of Soldiers: Octavo, pp. 96. Oliver Ditson & Co., Boston. Paper 50c, Boards, 60c, Cloth 75c.

This little volume contains about sixty of the best of the songs so popular among the soldiers during the war of 1861, with piano music and accompaniments, to which is added a selection of songs and hymns for Memorial Day.

We find among the songs many of our old favorites, such as: The Battle Cry of Freedom; Rally 'Round the Flag, Boys; Marching Thro' Georgia; Old Shady; Tenting on the Old Camp Ground; Tramp, Tramp, Tramp, etc. It is dedicated to the Grand Army of the Republic, and is just the thing for them at their post meetings, their camp fires, and their anniversary gatherings.

OTHER PUBLICATIONS RECEIVED.

A Revision of the Lysiopetalidæ, a Family of Chilognath Myriopoda, with a notice of the Genus Cambala, by A. S. Packard, Jr. On the Morphology of the Myriopoda, by A. S. Packard, Jr., read before the American Philosophical Society, June 16, 1883. Old School Medicine and Homeopathy, by J. W. Dowling, M. D., reprinted from the *North American Review*, June, 1882, pp. 26. U. S. Salary List and the Civil Service Law, by Henry N. Copp, Washington, D. C., 35c. Glaucoma, a paper read before Missouri State Medical Society, at Jefferson City, Mo., by Flavel B. Tiffany, M. D., of Kansas City, pp. 16. The *Irving Library*, Vol. I, No. 1, weekly, $25.00 a year, John B. Alden, New York. Remarks upon Hydrophobia, by Chas. W. Dulles, M. D., pp. 12. The *American Medical Journal*, Vol. XI, No. 10, edited by Geo. C Pitzer, M. D., St. Louis, Mo , monthly, $2.00. Variations in Nature, by Prof. Thos. Meehan, Philadelphia, Pa., pp. 14, read at the Montreal Meeting of the A. A. A. S., August, 1882. Iron from the Ohio Mounds, a Review of the Statements and Misconceptions of two writers of over sixty years ago, by F. W. Putnam, pp. 15, illustrated. Inaugural Address of President Charles O. Thompson, Rose Polytechnic Institute, Terre Haute, Indiana, pp. 27. Memoir on the Use of Homing Pigeons for Military Purposes, by Lieut. Wm. E. Birkhimer, Acting Signal Officer. To Foretell Frost, by Lieut. James Allen, Acting Signal Officer. The use of the Spectroscope in Meteorological Observations, by Winslow Upton, A. M. The *Continental*, Vol. I, Nos. 1 to 10, Baltimore, Md., monthly, 50c per annum. The *Canada Lancet*, Vol. XVI, No. 2, Toronto, October, 1883, $3.00 per annum. The *American Psychological Journal*, Joseph Parrish, M. D., editor, quarterly, P. Blakiston & Son, Philadelphia, $2.00.

SCIENTIFIC MISCELLANY.

EMULSIONS OF PETROLEUM AND THEIR VALUE AS INSECTICIDES.

C. V. RILEY, PH.D., WASHINGTON, D. C.

[*Abstract.*]

The value of petroleum for the destruction of insects has long been recognised, and I have for years been endeavoring to solve the question of its safe and ready use for this purpose without injury to plants. The paper contains the results of extended experiments carried on under my direction, by several of my assistants and particularly by Prof. W. S. Barnard, Mr. Joseph Voyle, of Gainesville, Fla., Mr. Clifford Richardson, assistant chemist of the Department of Agriculture, and Mr. H. G. Hubbard, who has for over a year been devoting his time to practical tests in orange groves at Crescent City, Fla.

Passing over the ordinary methods of oil emulsions by phosphates, lactophosphates and hypophosphites of lime and various mucilaginous substances, experience shows that, for the ordinary practical purposes of the farmer and fruit-grower, soap and milk are among the most available substances for the production of petroleum emulsions.

Ordinary bar soap scraped and rubbed into paste at the rate of 20 parts soap, 10 parts water, 30 parts kerosene and 1 part of fir balsam, will make, when diluted with water, an emulsion stable enough for all practical purposes, as the slight cream which in time rises to the surface, or the flakiness that often follows, is easily dissipated by a little shaking. Soap emulsions are, however, less satisfactory and efficient than those made with milk. Emulsions with milk may be made of varying strength, but one of the most satisfactory proportions is 2 parts of refined kerosene to 1 part of sour milk. This must be thoroughly churned (not merely shaken) until a butter is formed, which is thoroughly stable and will keep indefinitely in closed vessels and may be diluted *ad libitum* with water when needed for use. The time required to bring the butter varies with the temperature, and both soap and milk emulsions are facilitated by heating the ingredients. Ordinary condensed milk may also be used by thoroughly stirring and beating it in an equal or varying quantity of kerosene.

The diluted emulsion when prepared for use should be finely sprayed upon the insects to be killed, its strength varying for different insects or plants and its effect being enhanced when brought forcibly in contact with the insects.

Of mucilaginous substances, that obtained from the root of *Zamia integrifolia*, a plant quite common in parts of Florida, and from the stems of which the Florida arrowroot is obtained, has proved useful as an emulsifier.

These petroleum emulsions have been used with success by Dr. J. C. Neal, of Archer, Fla., against the Cotton Worm, without injury to the plant, but their chief value depends on their efficacy against the different scale-insects which affect Citrus plants. Experience so far shows that such plants do not suffer from its judicious use, but that it must be applied with much more care to most deciduous fruit trees in order not to injure them.

GAS FROM SAW-DUST.

"So far as we are aware," says the London *Timber Trade Journal*, "the making of illuminating-gas from saw-dust is a new branch of trade; certainly it is one of considerable importance, from the fact that it deals with what, in the majority of cases, is a waste product. We are advised that Mr. R. Tomlinson, late manager of the Cottingham Gas-Works, near Hull, has just completed the erection of the gas-works and lighting the town of Deseronto, Ontario, Can., the works being erected for the purpose of making gas from fine saw-dust. The gas produced is said to be far superior to that made from the best Silkstone coal, and to be equal to that made from the best cannel coal. It would appear that Mr. Tomlinson is especially commissioned in the above matter, for we learn that upon the completion of some water mains, which he has also in hand, he intends returning to England. As a basis for the manufacture of illuminating gas, saw-dust lays claim to many specialties, more so in the wood-producing countries of northern Europe and America, where coal has to be obtained at great cost, and where saw-dust is a greater drug and nuisance than in our own country. As saw-dust can be practically applied to the manufacture of illuminating-gas, it is clear, where the supply is at hand, towns may be illuminated by it; but it strikes us as being applicable, in a smaller and more general degree, in the case of illuminating saw-mills, joinery works and other establishments where saw-dust is produced."

THE MACKAY-BENNETT MARINE CABLES.

Messrs. Siemens, of London, are energetically pushing the work on the new Mackay-Bennett cables, now being manufactured by them at Charlton Pier, Woolwich. They will form a duplicate line from Ireland to Nova Scotia, continued from Nova Scotia by special cable to Cape Ann, and having a branch line from Ireland to France. The work was definitely begun last week, and though materials are still being prepared and tested, yet it is already possible to determine the character of the cables. Their core will contain a strand of eleven copper wires of highest conductivity, weighing 350 pounds per nautical mile, and the dielectric will consist of eight coatings of gutta percha placed upon the wire according to the improved method of Messrs. Siemens, and weighing 300 pounds

per nautical mile. The deep sea portion will be covered with galvanized steel wire and manilla hemp. All the intermediate cables are armed with steel wires. The shore ends are of the usual heavy types. Messrs. Siemens are convinced that nothing superior has ever come from their factories. They will introduce all the improvements suggested by years of research and experience. The length of the entire system of cables will be 5,600 miles. They will be laid by the steamer Faraday in the course of next summer. A visit to the works at Woolwich shows that everything is in a forward state of preparation.

SAMBO ON THE "RAIL-BIRD."

"I just whush," says he, "that some of dese fo'ks wat's all de time stud'in' ober bugs an' animals an' thin's wud fin' out wat kind ob a t'ing a rail-bud is, anyhow. Der' arn't nobody yit wat's eber 'now'd whar dey cum from or how dey cum's, whar dey go's, when dey go's, an' how dey go's. You may cum on dese ma'shes one day an' dey arn't no bud's; cum de nex' an' 'nock on you' boat wid you' oar an' dey answe's you f'om all 'round: 'Heah I is! heah I is!' But cum arter de fus' fros' and you doan' fin' 'em. Dey can't fly, dat's sart'in. Dey can't run hun'ered mil's in a nighttim', dat's shuah. Nobody 'nows nawfin' 'bout em. Dey mighty cut', and dey can run, swim an' div' jes' same lik' a wild duck an' a wild tu'key combin'. Ef dey won't fly yo' might as well lef 'em be. Tain't any mo' use in huntin' 'em than any thin' in dis whol' roun' wo'ld."

EDITORIAL NOTES.

THE Sixteenth Annual Meeting of the Kansas Academy of Science will be held at Topeka, Wednesday, Thursday and Friday, November 21, 22 and 23, 1883. The business meeting will be held Wednesday, November 21st, at 3 o'clock P. M. Wednesday and Thursday evenings will be devoted to lectures. Papers will be read and discussed on Thursday and Friday forenoons and afternoons. Friday evening a social meeting and reception will be held at the residence of one of the local members.

A full attendance of the members and of the friends of science generally is desired, as the programme promises to be full of interest, and business of importance is to be transacted, which will tend to increase the efficiency and usefulness of the Academy.

All persons expecting to present papers, or submit specimens, or introduce any scientific subject, are requested to send the titles and names of the same to the Secretary at their earliest convenience, that he may arrange them in the programme in time to distribute before the meeting.

The subject of the retiring President's address will be "The Organization and History of the Academy." The lecture on Thursday evening will be delivered by Dr. R. J. Brown, of Leavenworth; subject, "Deep Sea Fauna."

Reduced rates will be secured at the hotels; and also, from the railroads of the State.

For information address A. H. Thompson, President, Topeka, Kas.; or E. A. Popenoe, Secretary, Manhattan, Kas.

To any person remitting to us the annual subscription price of any three of the prominent literary or scientific magazines of the United States, we will promptly furnish the same, and the KANSAS CITY REVIEW, *besides, without additional cost, for one year.*

DURING the fall of 1883 a very large vein of fuller's earth was discovered in Dallas County, this State, which proved to be of excellent quality; equal if not superior to any found either in Germany or England. It is in several colors, yellowish-white, light brown and dark-reddish brown, and is pronounced first-class by both Professor Prescott, of Michigan University, and Carl Wenntrock, a German Mining Engineer of note. Mr. Wm. Jones, a chemist of this city, has analyzed it and finds a higher percentage of silicate of aluminum than is present in the English article. A company has been formed in this city to mine and sell it to manufacturers of woolen cloths, etc.

MR. WALTER G. MELLIER, of this city, brought home with him, from Colorado and New Mexico, some interesting relics of the former civilization of those regions, which he presented to the Kansas City Academy of Science. All such specimens are gladly received by the Academy, and our citizens may be assured that whatever they donate, geological, mineralogical, archæological, etc., will be labeled with the name of the donor, and carefully preserved.

PROF. BAIRD, of the U. S. Fish Commission, thanks the Life-Saving Corps for rescuing from the ocean and preserving to science several rare and unique specimens of salt-water fishes.

THE completion of the Kansas City, Springfield & Memphis R. R. is very properly a matter of great self-congratulation among the older citizens of this city, by whom it was planned more than twenty years ago. The immediate execution of the design is due to General Manager Geo. H. Nettleton, of the Kansas City, Ft. Scott & Gulf R. R., who has given all his energies to it for many months. The first freight train over the line consisted of fifty-six cars, all loaded in this city and gaily decorated by the shippers.

TEXAS has decided to abandon the system of letting the labor of its convicts for outside work on railways and farms, and is about to employ 1,000 convicts in the reduction of iron ore at the Rusk penitentiary.

PROFESSOR SNOW, of the Kansas University, has lately received large accessions to his museum in the way of mastodon bones from Kansas, and other fossils from Iowa. He also has our old friend, Judge E. P. West, in the field collecting archæological and geological specimens.

THE noted chemist, Professor J. Lawrence Smith, recently died at his residence in Louisville, Ky. He was an eminent scientist and a very prominently useful citizen, and his loss will be severely felt, both by his scientific associates and by his family, some members of which live in this city.

LIEUT. STONEY, of the Revenue Cutter "Corwin," reports the discovery in northern Alaska of an immense river hitherto unknown to geographers.

DR. EDWIN R. HEATH, the well known South American explorer, was married on Monday, October 15th, to Miss Jennie E. Gregory, of Jersey City, N. J., daughter of Mr. George Gregory, one of Dr. Heath's companions in the wilds of Bolivia.

SEVERAL samples of zinc found a short distance southeast of Butler, Missouri, have been brought in recently and are pronounced fine ore by parties who have had experience in mining this metal.

A paper read by W. M. Bowson at the Colorado Meeting of the American Institute of Mining Engineer seems to show that titanium is destined to become an important addition to the metallurgy of the future.

On the evening of August 25th the Island of Java, equaling in size New York, Pennsylvania, and Ohio, was shaken from end to end by volcanic action, and so vast a portion of its surface submerged beneath the sea that, as *Harper's Weekly* suggests, the story of the lost Atlantis may be regarded as brought within the range of probability.

Professor Parker, formerly of this city, now chaplain in the U. S. Army, has been transferred from Ft. Stockton, Texas, to Ft. Hays, Kansas, much to his satisfaction. He is now in this city enjoying himself among his friends for a short time.

Prof. G. C. Broadhead, formerly State Geologist of Missouri, gave us a brief call on the 19th ult. He still insists that the Legislature made a mistake last winter in not providing for the completion of the geological survey of the State.

The *Western Normal Advocate*, edited by C. L. Gregory and C. F. Holcomb, at Bushnell, Illinois, winds up a complimentary notice of the Review by saying, "*Every teacher should be a subscriber to this truly excellent periodical.*"

Miss Fannie E. Wright, a well known artist of this city, has recently returned from Europe, where she has spent the past year studying under the very best instructors, and has resumed giving lessons in painting at her home, 1105 Forest Avenue.

A cablegram announces the death of Prof. Wm. Denton, geologist, for the past two years making scientific explorations in Australia, New Zealand, and China. He is supposed to have been in Java at the time of the earthquake, and to have been one of the victims.

The publisher of the Review has for sale, very low, a large, fine, new parlor organ, suitable also for college chapel, lecture room, or church. It is one of the very best styles, and can be had at a decided bargain.

The Kansas City Review of Science and Industry is one of the ablest and best publications of its kind in the country, and has the especial merit of dealing with scientific questions in a manner that can be understood by the lay reader. The great fault of most publications of the sort is that they treat subjects of scientific interest in a manner too profound for the ordinary citizen, but the Review is purely popular, and therefore the more valuable.—*Chicago Inter Ocean.*

Prof. E. B. Seitz, of the Kirksville State Normal School, died of typhoid fever on the 8th of October. He was regarded as one of the finest mathematicians in the United States and his loss will be greatly felt.

Prof. R. S. G. Paton, late of Chicago, has been elected Professor of Chemistry in the Medical Department of the University of Kansas City, and is now engaged in delivering his winter course of lectures before the students of that Institution.

New York City is now in direct communication with Rio de Janeiro by telegraph, so that dispatches are now received in the Coffee Exchange only two hours after they are written. From Rio the new line has been extended by way of Montevideo and Valparaiso on land wires through South and Central America, crossing the Isthmus of Tehuantepec, and going thence by cable to Galveston, Texas. With improved facilities our trade with south America ought to be materially extended.—*American Grade Journal.*

We call attention to Dr. Fisk's article upon "Climate in the Cure of Consumption," reprinted from *Science* of October 5th, which number also contains its usual quota of timely and valuable papers, correspondence, etc.

Dr. Koch, of Berlin, who has been investigating the cholera in Egypt, finds that it is due to a "living, thread-like microscopic organism, resembling that seen in cases of phthisis."

I. T. SOULE, of Rochester, N. Y., has arranged with Gilbert Bros., of Spearville, Kan., for digging and operating seventy-five miles of irrigating canal, beginning at available points on the Arkansas River—one above Dodge City, near Cimmeron, and the other near Spearville, and terminating near Vanity. The work is to begin at once, and the canal completed as soon as possible.

THE awards to the United States at the Fisheries Exhibition, number 147, of which forty-five are gold, forty-five silver, and twenty-eight bronze medals, Also nineteen diplomas and ten money prizes. The United States Fish Commission gets eighteen gold and four silver medals, besides two diplomas.

THE reconstruction of Pine St., St. Louis, with asphaltum is completed, making an elegant drive. Locust Street has been begun. No heavy traffic will be permitted on these streets, but will be confined to the street between them, Olive, now being reconstructed with granite.

PROBABLY the earliest patent in this country was that granted by the Commonwealth of Massachusetts, to Samuel Winslow, who had invented a method of manufacturing salt. "None are to make this article," said the patent, "except in a manner different from his, provided he set up his works within a year."

THE Supervising Architect of the Treasury has received a sample of Missouri granite in connection with the bid of a granite company in St. Louis on the Pittsburg public building. This particular variety of stone attracted considerable attention in the architect's office, and Mr Hill pronounces it the finest specimen of building stone he had ever seen. It is deemed chiefly remarkable for its dark, rich color and susceptibitity of polish.

ONE of the most interesting exhibits at the Vienna Electrical Exhibition was Gentilli's Glossograph, a little instrument by which speech is automatically reproduced as soon as it is uttered. A small apparatus is placed in the mouth of the speaker—in contact with the roof of his mouth, his tongue and lips—and on being connected with an electro-magnetic registering apparatus the sounds are committed to paper.

As near as could be ascertained the yield of copper in Arizona, in 1882, was 15,000,000 pounds. The combined value of the silver and copper product for 1883 will be between fifteen and sixteen millions of dollars. This will place Arizona second on the list of bullion producers, and it is believed to be only a question of a few years when she will take the place which naturally belongs to her, and stand at the head of the list.

THE Saverton Lithographic Stone Co., of Ralls County, this State, has received an order from the Government which will amount to $150,000 a year, and henceforth all the postage stamps will be printed on stone taken from Ralls County, it having been fully demonstrated that it is the best in the United States for lithographic purposes.

SEVERAL changes have recently been made in the faculty of the University of Kansas. Thus Professor J. A. Lippincott, late Professor of Mathematics, at Dickinson College, takes the place of the highly esteemed Dr. James Marvin, as Chancellor; Prof. Edward L. Nichols, late of Central University, Richmond, Ky., takes the chair of Astronomy and Physics, in place of Prof. H. S. S. Smith, who has gone to Princeton N. J.; Prof. E. H. S. Bailey, late of Lehigh University, fills the place of Prof. G. E. Patrick, so long Professor of Chemistry. Each of these gentlemen brings with him a high reputation for scholarship and fitness for his special department, and it is to be hoped that these changes will prove profitable to the University of Kansas, though all of its old friends will long miss the familiar faces of the veteran professors.

A ship-canal across the Isthmus of Cornith is now under construction, though but little has ever been heard of it out this way. Work on

this historic ground was begun a year and a half ago and considerable progress has been made with it. Its length will be between three and four miles, its breadth about sixty-five feet, and depth twenty-five feet. A couple of French companies are making the excavation under a contract which calls for the payment of $4,920,000. At each end the canal traverses a plain. The middle section cuts through a ridge of solid rock from 120 to 240 feet high.

SOME appreciative but unknown correspondent of the Topeka *Capital* makes the following flattering reference to the REVIEW: "Among the productions of the Kansas City press Col. Theo. S. Case's REVIEW OF SCIENCE AND INDUSTRY takes a front rank. It is what its name implies, and is edited by a thorough scholar and scientist. It is a credit to this city, where the pursuit of wealth is such a ruling passion, that business men as well as scholars take time to read and interest themselves in its success. Teachers of Kansas will always find the subscription fund of this magazine a valuable investment."

REV. H. C. HOVEY, of Hartford, Conn., calls attention in the *Scientific American* to a newly discovered cavern in Crawford County, Indiana. It was first explored in September last and found to be wonderfully rich in rooms and halls embellished with fantastic stalactites, columns, drapery, etc. Its trend is southward; it is believed to be not less than two miles in length.

ITEMS FROM PERIODICALS.

Subscribers to the REVIEW *can be furnished through this office with all the best magazines of the Country and Europe, at a discount of from 15 to 20 per cent off the retail price.*

THE *North American Review* for November, by the liveliness and the sterling worth of the articles it contains, satifies the requirements of the most exacting reader. Senator H. B. Anthony writes of "Limited Suffrage in Rhode Island," giving incidentally a highly interesting sketch of the early constitutional history of that little Commonwealth. Dr. Norvin Green, President of the Western Union Company, in an article entitled "The Government and the Telegraph," cites the provisions of the Federal Constitution and the determinations of the Supreme Court which appear to debar the General Government from assuming the management of the telegraph lines. The Rev. David N. Utter, formerly pastor of the Unitarian Church of this city, brings out from oblivion his view of certain alleged atrocious crimes of "John Brown of Osawatomie." There are two scientific articles, namely, "Solar Physics," by Professor Balfour Stewart, and "Modern Explosives," by Gen. John Newton. W. H. Mallock contributes "Conversations with a Solitary." In "Suggestions in Regard to the Public Service," Green H. Raum offers certain facts going to prove that clerks and other employes of the Government departments at Washington, even before the passage of the Civil Service act, were in the main both faithful and efficient. Finally, "Dr. Hammond's Estimate of Women," as reviewed by Mrs. Lillie Devereux Blake, Miss Nina Morais, Mrs. Sara A. Underwood, and Dr. Clemence S. Lozier. Clubbed with the Kansas City REVIEW at $6.50 for both.

Harper's Monthly concludes its sixty-seventh volume with the November number which as ever, is filled with valuable, timely, and entertaining articles, while the illustrations are finer, if possible, than usual. No magazine published is better adapted in all respects for family reading than this. Subscribers to the REVIEW can obtain it at reduced rates by subscribing through this office, and now is the time to attend to it, as the December (Christmas) number will be the first of the new volume and will be an extra-attractive one.

WE notice an excellent article upon Glaucoma, in the *St. Louis Medical and Surgical Journal* for September, by our fellow citizen, Prof. Flavel B. Tiffany, of the University of Kansas City. It is exhaustively written and fully illustrated.

Psyche, an entomological magazine of high standing in scientific circles, is now in its tenth year, but has never reached the paying basis that its excellence merits. Of the associate editors, four are the State Entomologists respectively of Michigan, Illinois, New York and Kansas. Prof. Trelease is a botanist, Professor in Wisconsin State University. Dr. Dimmock is a graduate of Harvard College and the University of Leipzig; Mr. Mann is Assistant Entomologist of the U. S. Department of Agriculture, and was formerly Entomologist to the Government of Brazil. Mr. Mann has been editor of *Psyche* from the outset. It is published monthly at Cambridge, Mass., at $1.00 per annum.

THE *Atlantic Monthly* for November, 1883, presents the following excellent table of contents: A Roman Singer, IX., X. F. Marian Crawford. Ezra Ripley, D. D., Ralph Waldo Emerson. The Trustworthiness of the Hebrew Traditions, Brooke Herford. Charon's Fee. Newport, X., XI. George Parsons Lathrop. A Noble Lady, Maria Louise Henry. En Province, V, Henry James. Omens, Edith M. Thomas. The Bird of the Morning, Olive Thorne Miller. Random Spanish Notes, Charles Dudley Warner. Recollections of Rome during the Italian Revolution, II., William Chauncy Langdon. An Only Son, Sarah Orne Jewett. Venice, Christopher P. Cranch. The New Departure in Negro Life, O. W. Blacknall. What Instruction should be given in our Colleges? Albert S. Bolles. A Good-Bye to Rip Van Winkle, Gilbert A. Pierce. The Songs that are not Sung, John Boyle O'Reilly. The East and the West in Recent Fiction, James Buchanan. The Contributors' Club. Books of the Month.

THE *Mexican Financier* gives an account of a new fuel invented in the City of Mexico, called "turbato." It consists principally of bog peat, of which there are immense quantities in Mexico, mixed with a proper proportion of bitumen or chapopote. The fuel is made in five different classes: for locomotives, stationary engines, smelting purposes, smiths' fires, and household purposes. It burns freely and without much smoke, giving a higher dynamic equivalent of heat than the same amount of wood, and very nearly as great as the best English coal. It can be manufactured and sold in Mexico at a price considerably below coal or wood.

THE *Educational News*, published at Adrian, Michigan, by Wm. B. Mumford, says of the REVIEW, "Its readers get value received for their investment."

Popular Science Monthly, for November, gives considerable space to the "Greek Question." It contains an article by Professor Josiah P. Cooke, of Harvard College, and an editorial by Professor E. L. Youman in opposition to that of President Porter in the last *North American Review*, and in support of Charles Francis Adams' attack upon the study of this language in colleges.

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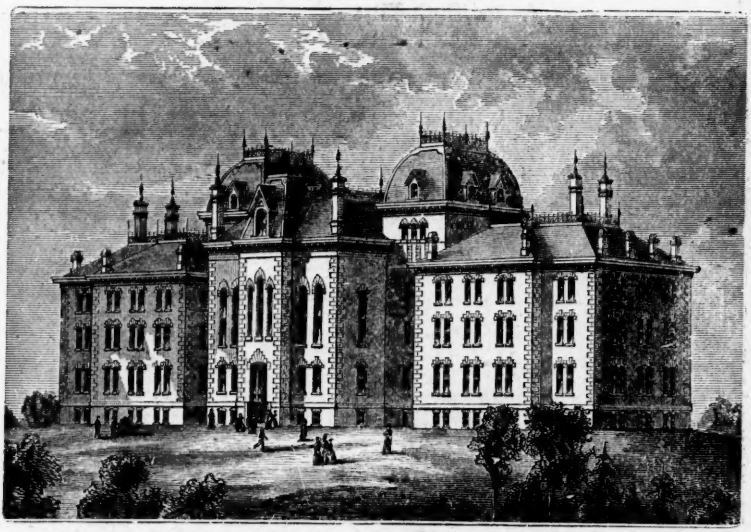

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